GRASSED AND PLANTED AREAS BY MOTORWAYS

A REPORT BASED ON INFORMATION GIVEN IN 1974/75 BY THE DEPARTMENT OF THE ENVIRONMENT AND COUNTY COUNCIL HIGHWAY DEPARTMENTS, WITH ADDITIONAL DATA FROM OTHER SOURCES

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CHAPTER 1

INTRODUCTION

This report on the extent and other characteristics of grassed and planted areas associated with motorways, is written assuming that they are potentially important for the conservation of wild plants and animals. This idea was first publicly suggested by Williams-Ellis (1967), and coincidentally by Moore (1967). Williams-Ellis's booklet 'Roads in the Landscape' reflects the thinking at that time of the Ministry of Transport's Advisory Committee on the Landscape Treatment of Trunk Roads under its then Chairman, Sir Eric Savill. It was suggested specifically that '... the roadside verge, particularly on the motorway where pedestrians are forbidden, should become a nature reserve and provide a new and secure habitat for our wild flowers'. The Advisory Committee, referred to by its short title as the Landscape Advisory Committee, now reports to the Secretary of State for the Department of the Environment. Although the scope of its interests and of its functions have widened and changed since the early days of its formation, it continues under its present chairman, Sir George Taylor, to strongly support ideas on the natural development of motorway banks and verges, and of the importance of these areas for wildlife. Similarly in a number of letters and memoranda to Agent and Highway Authorities, the Ministry of Transport and subsequently the Department of the Environment have also supported these views.

Grassed and planted areas by motorways are here defined as the ground between the hard shoulder and the boundary fence. The term 'verge' is not strictly appropriate, especially as a considerable proportion is either made up of embankment, or cutting. The whole area (excepting ditches) is sown with grass at an early stage (Chapter 4), but subsequently substantial plantings of shrubs and trees may be made (Chapter 5). Of the grassland, some areas were managed by mowing or chemicals at least once per season up to 1975 (Chapter 7); other areas, after management during the establishment phase, have since been unmanaged and allowed to grow wild.

The first sections of motorway built after the Special Roads Act 1949 (HMSO, 1949) were completed in 1959 and subsequent statistics of the development of motorways are given in the annual reports of the Minister of Transport, and subsequently the Secretary of State for the Environment, entitled "Roads in England" (HMSO 1960 to 1975). There are some statistical differences over the precise mileage of motorway open at any given point in time, depending upon rounding-off errors and the date of collection of information - this report estimates a total of 1763 km (1102 miles) at the end of December 1974 (Chapter 2). In addition to the mileage of road to which motorway regulations apply (the criterion used in calculating the figure above), an unknown but possibly significant mileage of new ancillary roads has been built in connection with the motorways including link roads and junctions.

Specifications for the design of rural motorways have evolved over the years. A typical description and cross-sectional layout are given in the 'Layout of Roads in Rural Areas' (HMSO, 1968), and consist essentially of a 1.5 m (5 ft) verge, 3.2 m (10 ft 6 ins) hard shoulder and two or three 3.7 m (12 ft) lanes for each carriageway with a central reserve of 4.0 m (13 ft), giving overall dimensions of 28 m (92 ft) for a four lane, and 35.4 m (116 ft) for a six lane motorway. Specifications for the construction of motorways, including earthworks, establishment of grass and planting of hedges, are set out in the 'Specification for road and bridge works' (HMSO, 1969).

The Highway Authority for trunk road motorways is the Department of the Environment, operating through a headquarters in London and a network of Regional Controllers (Roads and Transportation). The majority of motorways have trunk road status, but a small mileage of local authority motorways (see Appendix Table 2.2) do not. The maintenance of trunk road motorways (for which 100% grant is paid) is delegated to Agent Authorities, who, in rural areas are the County Councils. Within County Councils the County Surveyor (or comparable officer) is responsible. In counties where there is a reasonable mileage of motorway a special appointment may be made for one officer to have full time day to day responsibility, but in other counties motorway maintenance may be only a part of the duties of existing Divisional or Area engineers having other county duties. This, as will be seen, makes for a wide range of different interpretations of policies and instructions, and to a wide range of approaches to their implementation.

This report is based on information supplied by the Department of the Environment and by County Council highway departments. All County Councils (with exceptions noted below) having responsibility for sections of motorway in England (and Gwent in Wales) were visited : where possible the visit was to the Officer having day to day responsibility, with the intention of gathering information about the practical problems and operations of motorway maintenance programmes. In all, 32 Council offices were visited, representing 29 Councils. 26 Councils were managing existing sections of motorway, two (Greater Manchester CC and West Midlands CC) were about to take over lengths of completed motorway from other authorities (Merseyside CC in the same category was not visited), and one (Oxfordshire CC) was about to take over a newly opened section of the M40 from the Department of the Environment and the Contractors. The London Boroughs of Barnet (M1) and Hounslow (M4) were not visited because much of the motorway in these boroughs was essentially urban (although not necessarily without grassed or planted areas); Devonshire was not visited as the only section of the M5 completed there was the Cullompton By-Pass (numbered A38(T)), not yet subject to motorway regulations. West Glamorgan CC in Wales was not visited for logistic reasons, and because of the rather short lengths of the very recently opened sections of the M4 and A48(M) in the Swansea-Port Talbot district. Since the data were collected parts of the M23 (London-Crawley Motorway) in Surrey, and the M55 (Preston Northern By-Pass) in Lancashire have been completed, but information about these and other sections of motorway opened after the end of 1974 are not included in this report.

Data have also been used that were collected in 1970 at the time of a botanical survey of the M1 from Hendon to Leeds by the Nature Conservancy, with financial support from the Ministry of Transport, and also from subsequent physical surveys of parts of the M4, M5 and M6. In addition, continual reference has been made to 1 : 63,360 (one inch to the mile) and 1 : 50,000 maps of the Ordnance Survey; to the 1 : 625,000 (10 miles to the inch) OS Route Planning map of Great Britain 1975, published in 1974; to the Bartholomew Motorway Atlas of Britain (ed. Bladon, 1973) and to Motorways (Dunlop n.d. strip maps).

CHAPTER 2

DISTRIBUTION AND MILEAGE OF MOTORWAYS, WITH ESTIMATES OF ACREAGE OF GRASSED AND PLANTED AREAS

The distribution of motorways and their relationships to Local Authority boundaries (post April 1975) are shown in Appendix Figures 1 - 5.

Information on the mileage of motorways (Appendix Tables 2.1 and 2.2) refers to the sections open to traffic at the time of collection of the data for this report (November 1974 to January 1975). The sources of data are mileages given by the Agent Authorities themselves; mileages tabled in a Department of the Environment Press Notice dated 18 October 1974; mileages given in a DOE analysis of the completion dates of the Motorway network by Contract lengths dated 31 July 1973, and mileages given in the Department's reports "Roads in England 1973-74" (HMSO 1974). The most recent edition of the latter for 1974/75 (HMSO 1975) gives a figure of 1702 km (1064 miles) of motorways in England and Wales (excluding Local Authority motorways) up to the date of its drafting in 1975.

In Appendix Table 2.1, based mainly on DOE figures, a total of 1766 km (1104 miles) of motorway is given, including 83.8 km (52.4 miles) of Local Authority motorway. Appendix Table 2.2 on the other hand is derived largely from Agent Authority sources and gives a total of 1742 km (1089 miles), including 83.8 km (52.4 miles) of Local Authority motorway. The discrepancy of 24 km (15 miles) between the totals in the two tables is largely attributable to rounding-off errors. In Appendix Table 2.3 a total 1763 km (1102 miles) has been calculated, and as this is the mileage used for calculating acreages it will also be used in this report as the definitive figure.

The contract lengths for DOE purposes are described by place names, which usually coincide with a junction or an interchange. Agent Authorities, with two exceptions, take convenient interchanges or junctions as inter-Authority boundaries, and as a result one Authority may be working inside another's administrative boundary so far as motorway maintenance is concerned. The description of sections of motorway by place names can be confusing as some of these are only of local significance (such as Holcroft Lane on the M62 or Piffs Elm on the M5) and do not appear on one inch or 1 : 50,000 Ordnance Survey maps. For this reason (and because they are usually the Local Authority boundary for maintenance purposes) junction numbers are used in this report when describing sections of motorway.

In Appendix Tables 2.1 and 2.2 the Maintaining Authorities for the sections of the motorways are shown as they stand following the reorganisation of Local Government boundaries in April 1975 (after the collection of data for this report). The most significant changes have occurred in the Cheshire/Lancashire area, with a considerable mileage of motorway having been transferred from Lancashire to the new Greater Manchester County Council in particular. In other areas, the new County Council of South Yorkshire has taken over responsibility for two thirds of the M1 previously maintained by the West Riding of Yorkshire, together with the M18 and the A1(M) Doncaster By-Pass. The new West Midlands County Council and the Avon County Council have acquired lengths of motorway respectively from the neighbouring counties of Warwickshire and Staffordshire, and Gloucestershire and Somerset.

A number of counties visited provided estimates of the acreages of managed and unmanaged grassland, and of planted areas, associated with the lengths of motorway for which they were responsible. These have been compared with estimates made at Monks Wood from measurements taken from the hard shoulder to the boundary fence on the M1 (Hendon-Leeds), the M4 (Slough-Severn Bridge), the M5 (M6 interchange-

Strensham), and the M6 (M5 interchange-Manchester Ship Canal); involving 356, 150, 64 and 108 records respectively. There was good agreement between the estimates of acreages made from these cross sections of the land, and those derived by the Agent Authorities in other (unspecified) ways, except for the M4 in Wiltshire, where there was a discrepancy (County Council estimate 22.4 acres to the mile, Monks Wood 13.26). The Monks Wood figures do not include central reservations, nor land at interchanges, junctions and slip roads. Appendix Table 2.3 is based on figures derived from these two sources, or where no measured data exists (e.g. the M18) mean acreages per mile have been derived from other neighbouring areas where measurements have been made. For the M40 it was thought that the M2/M20 in Kent might be topographically comparable (the M3 in the Hampshire chalk might also be similar), rather than the physically closer sections of the M1 or M4. For Urban Motorways, that is motorways passing through built up areas, often with some proportion of their length on viaduct, a mean of 5.8 acres to the mile has been used based on 21 miles of the M6 Midland link from Junction 3 to Junction 7, including 'Spaghetti' junction at Gravelly Hill, formerly in Warwickshire. Nine miles of this length are on viaduct, but some other areas have sizeable cuttings and embankments.

In Appendix Table 2.3 a total of 5603.4 ha (13,839 acres) is estimated for 1763 km (1102 miles) of motorway (rounded off), giving an average of c.3.2 ha/km (12.6 acs/mile) for the existing motorway system. This is probably an under rather than an over estimate, but is almost double the minimum figure of 1.6 ha/km (6.5 acs/mile) quoted by Ward (1970).

It would be misleading to calculate average figures for the individual motorways as each one traverses a range of land types and all have been designed and built in sections over a number of years. However, it is interesting to note differences between the first 112 km (70 miles) length of the M1 from Hertfordshire to Northamptonshire, opened in 1959, and the greater land-take associated with the later sections from Leicestershire northwards, which probably reflects a change in policy as well as a change in topography. Likewise the relatively narrow cross-section of the earlier lengths of the M5 in Staffordshire (formerly) and Worcestershire, compared to later sections in Gloucestershire, also reflects a change in policy as the topography of the Severn Valley and its tributaries, in which the route runs for the most part, is comparatively unchanging.

The two main factors influencing land-take for motorways in rural areas are the agricultural quality of the land, and considerations of geology and soil mechanics. The angles of cutting slopes for instance are largely governed by soil stability and problems of 'slumping' and erosion. Standard slopes were 1 : $1\frac{1}{2}$ on the earliest motorway section, but were later changed to 1 : 2, which is the present standard. In Chalk areas and where other stable bedrock conditions are found, the slopes may be steeper, but in areas where there are unstable conditions they may be considerably shallower. So far as the agricultural quality of the land is concerned, it is sometimes possible to take more land for landscaping and other purposes in areas of low agriculture value (more often in upland regions), but in most parts of the country the land take is confined to the minimum compatible with the engineering standards currently in force.

CHAPTER 3

GEOLOGY AND LAND USE

Geology

Lines of communication involving systems of road, rail and canal transport pass through many geological strata and soil types. In doing so the different rocks and soils contribute to the rich and diverse range of habitats for wildlife that are found.

So far as motorways are concerned, it is possible that variation in geology will be of less consequence for wildlife than for other roads. This arises partly because motorways have been laid down like a ribbon on top of existing rock and soil formations (sometimes using imported materials), and partly because they have generally been sited in low ground, avoiding 'difficult' geological strata. They have also avoided, so far as possible, high grade land or land having other desirable characteristics from landuse, landscape or conservation points of view. In this respect they are similar to railways and canals, but different to traditional roads, which follow natural drainage patterns and rarely have embankments or cuttings, although some have 'sunk' into the land as a result of erosion and wear.

An important concept in the construction of motorways has been the balancing of cut and fill (materials taken from cuttings to build up embankments), but nevertheless considerable quantities of imported material such as fly ash from power stations (M5 in Somerset) and colliery waste (three quarters of a million cubic yards on the M62 between Lofthouse and Ferrybridge in Yorkshire; HMSO 1972) have been used. Even with fill extracted from adjacent higher ground the materials often lie unconformably on the native soils and strata of the lower ground.

As with foundation materials, so also with the soils that are used (see Chapter 4) to provide rooting substrate for the initial grass cover. Although there is comparatively little long distance transport of these soils, nevertheless they are often so modified by stripping, storage, transport and spreading that many of their individual characteristics are lost. This is exacerbated by their being laid on highly compacted foundations, probably with different drainage characteristics from their native sites.

Because of these considerations it should not be assumed that the natural flora of adjacent areas, and especially the less common species of plants, will necessarily colonise the banks and verges of motorways, particularly in the short (10 years) to medium (50 years) term. This may be the case particularly for plant communities or assemblages associated with woodlands and old grassland. Differences will be more marked when chalk or limestone fill has been used in neutral or acid areas (such as valley bottoms), or acid material brought into base rich areas.

Although motorways may be independent in their early years of the soils and geology of their immediate surroundings, they are in other important ways strongly influenced by them. Thus the route that a motorway takes, its gradients and curves are consequences of geology. Outside the motorway boundary the landscape through which it passes, and thus the landscaping that it is necessary to do to it, are largely dependent on geology and soils.

Motorways in England and Wales do not continue on any one geological stratum for more than 40 km (exceptionally for about 90 km of the M1 between Nottingham and Leeds on Productive Coal Measures), and mostly not for distances of more than 20 km. Similarly there are rapid changes in the geology of the surrounding districts within 5 or 10 km of the routes. Consequently the work of those responsible for motorway landscaping is both made easier and more difficult. Easier because focii of interest are usually present within vision almost all the time (unlike some of the flat, unrelieved areas of countryside of parts of northern Europe, or the deserts and plains of North America); more difficult because of the responsibility of fitting the large engineering works of modern motorways into very diverse and often small scale landforms. The success with which this has been achieved can be seen in comparisons between aerial photographs of motorways and ground views. From the air, motorways and associated structures are obtrusive and often out of scale, whilst railways in comparison generally appear to be in scale, although aggressively linear. Ground views of motorways are usually impressive rather than displeasing, whilst extensive views of them from the surrounding countryside are remarkably difficult to obtain. Where views are obtainable most stretches of motorway are visually quite acceptable, although exceptions (notably when the motorway is on embankment) will be apparent.

In the accounts that follow only sedimentary ("solid") formations (Geological Survey, 1957) are discussed. These are the basis of the land forms throughout most of the country. Descriptions of superficial and drift deposits (including Glacial Boulder Clays, which are largely responsible for landform in much of the Midlands and some parts of the north of England), and of soils, are beyond the scope of this discussion. However, in so far as soils, together with the characteristics of the geology, determine (inter alia) vegetation, and vegetation plus landform synthesise into landscape, they cannot be ignored if a more detailed understanding is to be obtained.

M1 LONDON-YORKSHIRE MOTORWAY

The M1 begins on the Eocene London Clays and passes through a narrow band of the Reading Beds north-west of Watford, to cross the Vale of St. Albans on to the Chalk of the Cretaceous period in the Chilterns, and down past Luton. Gault clays outcrop in the region of Toddington Service area, and the Lower Greensand at Woburn. Between Ridgmont and a very narrow band of Middle Jurassic Cornbrash at Newport Pagnell the route runs through a region of Upper Jurassic Oxford clay. It continues through the Middle Jurassic Oolites south of Northampton onto the Lower Jurassic Lias clays and silts to the southwest and west of Northampton, with the Middle Lias appearing at Watford Gap. Northwest of Northampton to the north of Lutterworth the Lower Lias clays of the Northampton Uplands are crossed. Through the remainder of Leicestershire and parts of Derbyshire, to just south of Nottingham, the motorway lies mostly on Triassic Keuper Marls of the New Red Sandstone, threading its way through the pre-Cambrian Charnian series of Charnwood Forest in the vicinity of Quornden and Mountsorrel. Immediately in the area of Nottingham there is a small stretch of Keuper Sandstone, and of Permian Magnesian Limestone and Marls, before the route meets the Productive Coal Measures of the Carboniferous period, on which it lies for the remainder of the way to Leeds. It should be noted, however, that approximately from the Great Ouse at Newport Pagnell to the Trent at Nottingham, the landform is dominated by Glacial Boulder clays of Pleistocene origin. If these were stripped away a totally different landscape would emerge.

M2 MEDWAY MOTORWAY

The M2 runs alternately over the chalk of the Cretaceous and the predominantly sandy Woolwich and Thanet Beds of the Eocene, before ending just to the west of Canterbury on London Clay. The passing and repassing between the main strata makes this motorway one of the most diverse and scenically attractive.

M20 MID-KENT MOTORWAY - sections open in 1974 immediately to the north and east of Maidstone

These sections of the M20 lie at the foot of the chalk of the North Downs to the north and east of Maidstone, on Cretaceous Upper and Lower Greensands, Gault clays, and some small areas of the older Wealden Clays.

M3 LONDON-BASINGSTOKE MOTORWAY

Starting on the London Clays of the Eocene, and the Recent gravels and alluvia of the London Basin, the M3 passes onto the clays and sands of the Bagshot, Bracklesham and Bacton Beds between Chertsey and a point east of Hook. In the region of Hook the motorway comes back onto London Clay for a short distance and, after crossing a narrow band (less than 1 km) of the Reading Beds, it lifts onto the chalk between Hook and Basingstoke until its present end at Popham, north of Winchester. The M3 thus has three quite distinct sections of great contrast successively from London Clays, to the acid sands and clays of the Bagshot, Bracklesham and Bacton series, and finally onto the Hampshire chalk.

M4 LONDON-SOUTH WALES MOTORWAY

The M4 starts on London Clays and continues on them until it meets and alternates with Reading Beds in the region of Slough, past Maidenhead and south of Reading to Theale, essentially in the Thames Valley but not following the R. Thames itself. From Theale to Chievley it crosses onto the Berkshire Downs, alternating between the Eocene Reading Beds and the chalk of the Cretaceous. From Chievley to Wanborough, southeast of Swindon, it continues on across the chalk of the Berkshire and Lambourne Downs to Wanborough where it drops down into the Vale of the White Horse. In this area it crosses the Cretaceous Upper Greensand and Gault clays, and subsequently the Kimmeridge Clay of the Upper Jurassic to the west of Swindon. It continues through a narrow band of Jurassic Corallian stratum and an area of Oxford Clays near Brinkworth to a point east of Hullavington. At Hullavington it passes on Jurassic strata through a band of Cornbrash to Oolitic Limestone past Badminton and Tormarton, to drop sharply down at Tormarton, through narrow bands of Upper and Middle Lias Clays, to a rather broader band of the Lower Lias near Westerleigh. Thence it alternates between Triassic Keuper Marl of the New Red Sandstone, the Barren Upper Coal Measures of the Carboniferous, across more Keuper Marl onto Jurassic Lower Lias, and outliers of Carboniferous Limestone to the Severn Bridge. On the Welsh side of the River Severn it crosses an area of Keuper Marl to the south of Chepstow and onto Carboniferous Limestone south of Shirenewton, where it alternates with Keuper Marl to a point west of Magor. After this it crosses a narrow band of Upper Devonian strata, Keuper Marl and Lower Lias, to end up on the Lower Devonian to the west of Newport.

M40 LONDON-OXFORD MOTORWAY

Starts to the northwest of Uxbridge on London Clays and alternates between them and Reading Beds until it meets the chalk northwest of Beaconsfield. The major part of the route lies on the chalk of the Chiltern Hundred, passing Loudwater on Viaduct, south of High Wycombe to Stokenchurch and the Chiltern scarp at Aston Rowant, down to a point to the northwest of the junction with the A4009 and crossing the Icknield Way. Subsequently it crosses a band of Upper Greensand and Gault to a rather confused area of Upper Jurassic Portland Beds, Cretaceous Lower Greensand and Upper Jurassic Kimmeridge Clay in the Vale of Aylesbury, to its present end southeast of Wheatley.

M5 BIRMINGHAM-BRISTOL-EXETER MOTORWAY

The M5 starting in Birmingham runs over the Carboniferous Barren Upper Coal Measures to the south of the City, crosses the Bunter and Keuper sandstones of the Triassic period, and then passes onto Keuper Marls south of Bromsgrove. It remains on the Marls past Droitwich, Worcester and Upton-on-Severn, where it strikes south-east onto Lower Jurassic Lower Lias, by-passing Tewkesbury and Gloucester to the East, and continues down the Vale of Gloucester and Vale of Berkeley, almost as far as Berkeley on this stratum. Between Berkeley and Almondsbury the geology is very confused and for a distance of about 25 km passes successively over Keuper Marl, an Upper Cambrian stratum, a Silurian stratum, back onto Keuper Marl, across a Middle Devonian stratum followed by Carboniferous Limestone and lastly onto Jurassic Lower Lias. From Almondsbury southwards the route essentially lies on Keuper Marls past Avonmouth and Clevedon to south of Bleadon. Immediately southwest of Avonmouth the road runs side-long on a Carboniferous feature of Barren Coal Measures and Carboniferous Limestone, whilst there is also a small crossing of the Limestone again in the region of the Mendips. Subsequently the route crosses about 15 km of Lower Lias north and south of Highbridge, and back onto Keuper Marl north and south of Bridgwater, to cross about 3 km of Keuper Sandstone south of North Petherton. From Taunton to south of Wellington the route comes back onto Keuper Marl before passing over a 3 km stretch of Keuper and then Bunter Sandstone, finally continuing from just east of Sampford Peverell on Permian Sandstones to its present end north-east of Exeter.

In effect the sections of the M5 open in 1974 run for most of their length on Jurassic and Triassic Clays at low altitude down the Severn Valley, Vale of Gloucester and Vale of Berkeley, and again through the Somerset Levels. However the rather flat scenery of the immediate surroundings is relieved to the north of Almondsbury by the Jurassic Oolitic formations of the Cotswolds and outliers to the east, and by the Devonian and Silurian strata of the Malverns, Hereford and Worcester, and Gwent to the west. South of the R. Avon the Mendip, Quantock and Black Down Hills provide continuing interest.

M6 CATTHORPE-BIRMINGHAM-PRESTON-CARLISLE MOTORWAY

The M6 Midland Link strikes northwest from the M1 at Catthorpe in Leicestershire on Jurassic Lower Lias, moving onto Triassic Keuper Marl near Pailton, and continuing on this until it crosses a narrow band of Keuper Sandstone north of Coventry. From there it traverses about 15 km of Carboniferous Barren Upper Coal Measures and then comes back onto Keuper Marl east and northeast of Birmingham. Emerging to the north-west of the Birmingham-Wolverhampton conurbation on Bunter Sandstone, the route passes over a 3 km band of Keuper Sandstone onto Keuper Marl at Penkridge, and remains on this to the west of Stafford to a point about 10 km south of Newcastle-u-Lyme, where, over a distance of about 20 km (by-passing Newcastle) it crosses successively Bunter Sandstone, Barren Upper Coal Measures, Bunter Sandstone, Keuper Sandstone, and again onto Keuper Marl southeast of Crewe. It remains on the Marl through the Cheshire Plain past Sandbach, Middlewich and Northwich to High Legh, where it strikes a narrow band of Keuper Sandstone before crossing the Manchester Ship Canal onto Bunter Sandstone. From Makerfield to Ecclestone, by-passing Wigan, the route is on Carboniferous Productive Coal Measures. Thence, over about 4 km, it crosses Bunter Sandstone, Keuper Sandstone, back onto Keuper Marl south of Preston. The Preston By-Pass on up to Garstang lies on Bunter Sandstones, and from there to south of Halton, including the Lancaster By-Pass, the motorway is on Carboniferous Millstone Grit and Culm measures. From this point to Sedgewick the route is on Carboniferous Limestones, and from there to Tebay on Silurian rocks of the Ludlow series. At Tebay there is a narrow band of about 1 km of Carboniferous Basement Limestone Conglomerate before the Carboniferous Limestone itself, which carries the road up to Armathwaite, narrowly impinging on Permian series of the New

Red Sandstone to the west of Penrith; this series is crossed between Armathwaite and Wreay south of Carlisle. The final section of the Carlisle By-Pass lies on Triassic Keuper Marls and Sandstones.

Thus most of the M6 lies on the sandstones and marls of the Triassic, from the junction with the M1 in Leicestershire up to Garstang, north of Preston, and even at the end by Carlisle. Between Garstang and Carlisle, for a distance of c.70 km, the motorway crosses a series of hard rock strata of the Carboniferous and Silurian periods. However, as with the M1 motorway, for substantial areas of the countryside (especially northeast of Coventry, northwest of Birmingham, and from Stoke to Carlisle), surface features are mainly a consequence of overlying superficial deposits of Boulder Clays.

M62 LANCASHIRE-YORKSHIRE MOTORWAY

This road connects with the M57 in east Liverpool, in an area of Carboniferous Productive and Unproductive Coal Measures, but, although it touches on these strata again, the major part of the route round to the north of Manchester is over Triassic Bunter Sandstones, with minor excursions onto Keuper Marl and Keuper sandstone. For part of its route to the west of Manchester the deep peats of Chat Moss are crossed. From Middleton until it rises onto the Millstone Grits of the Pennines, the motorway crosses an extensive area of Productive Coal Measures, which it does again when it drops off the Millstone Grit at Elland and remains on the Coal Measures for about 40 km south of Bradford and Leeds, to meet the Permian Magnesian Limestone at Normanton. About 5 km of the Magnesian Limestone are crossed on an east/west axis, and some minor outcrops of Middle Permian Marls, before the present ending (1974) of the motorway on the Keuper Sandstones of South Yorkshire.

OTHER MOTORWAYS

Similar accounts could be written for other motorways (e.g. M18, M61, M55, M56); whilst potentially interesting routes will be opened up by the M11 from London-Cambridge, M23 London-Crawley, and the M27 Portsmouth-Southampton-New Forest, amongst others under construction.

Land Use

As mentioned earlier in this Chapter, motorways have been laid onto the countryside like a ribbon. In doing this the designers have been forced to select certain sorts of land for either engineering or social reasons. Thus built-up areas, grade 1 or 2 agricultural land, woodlands, parks, nature reserves and Areas of Outstanding Natural Beauty have been avoided wherever possible, as also have hilly localities and routes involving too many structures or major earthworks. In Text Table 1 an analysis has been made of the 'neighbouring landuses' recorded in the 1970 survey of the M1, and the 1973 surveys of the M4, M5 and M6 (see Chapter 2). These can be compared (Text Table 2) with data extracted from the very few maps of the Second Land Utilisation Survey of Britain that have been published that cover parts of motorway routes. In both tables the land uses have been divided between those where there is little or no wildlife interest (arable fields, improved grassland and housing/industry/newly disturbed land), in contrast to land of potential wildlife interest, including rough or unimproved grassland, woodland (whether natural or planted), wastes/railways,and old roads/gravel pits.

If all grassland is taken together (it is not possible to differentiate on the Land Utilisation Maps, and the Monks Wood records are a matter of judgement) there is close agreement between the overall acreages given in the two tables for the various categories. About one third of the land take overall is arable land, one third grassland and one third other land uses. The differences between the motorways

reflect broad regional differences, although it is difficult to make generalisations about individual motorways as each one crosses so many differing land types. Each motorway may have its own character and one that is not easy to analyse statistically. So far as land use is concerned these differences depend on topography, soils, and climate: thus the northern parts of the M1 are more likely to be comparable to the Yorkshire sections of the M62 than the southern parts of the M1.

The data in Text Tables 1 and 2 are taken from both sides of the carriageway. Because motorways very rarely slice through woodland (there are notable exceptions such as the M3 in Surrey and Hampshire, the M2 through the coppice woodlands of Kent, the M40 at Aston Rowant, the M50 Ross Spur in Hereford), most of the data for woodland represent occurrences on one side of the motorway only where, at a given point, the route has followed the edge of a wood, or has taken off a corner. Similarly, in urban areas, motorways (which may often follow a line that has been protected from development for other purposes for some time) more often follow the edges or boundaries of built-up land, than force their way through established housing.

Excluding grassland, about 20% of the land use on one side or other of the motorways surveyed were woods, railways, canals, gravel pits and other non-agricultural areas of possible wildlife value. For colonisation by wildlife of newly disturbed land, nearby sources of seeds and plant propagules are necessary. Thus, on the one hand the most important wildlife habitats have generally been undisturbed by the construction of motorways, and along a proportion of their length there are areas that will be rich sources of propagules. On the other hand because 80% of the neighbouring land use is intensively managed by agriculture, there will generally be a poor chance of natural invasion for the greater proportion of the length of the motorway system. Invasion of these areas by native plants will have to come from farther afield, or, in the long term, by natural spread along the motorway corridor.

Comparisons can be made between the 20th Century development of motorways, and the 19th Century development of railways. Although the criteria for the choice of routes for the railways may have been different to the present day motorways, many of the engineering characteristics are the same. There are grounds also for supposing that the biological interest of motorways may develop in the same way, although management, especially with regard to burning of the banks, may be different. However, it is also possible that the modern efficiency of agriculture, and intensity of management of the countryside generally, have substantially reduced the area of wildlife habitats available as a source of propagules for motorway land, in comparison to the situation during the period when the railways were developing.

Text Table 1. Percentage occurrence of different land uses by motorways. From Monks Wood surveys (direct records).

	Land use	M1 Hendon-Leeds	M4 Slough-R. Severn	M5 M6-Strensham	M6 M5-Manchester Ship Canal	Average from all data weighted for different lengths of individual samples
Non-Wildlife Habitats	(Crops	35	35	19	22	31
	(Improved grass ((including orchards)	20	18	34	53	26
	(Industry/housing	15	12	20	12	15
Wildlife Habitats	(Unimproved grass	8	19	17	4	11
	(Woodland	6	9	2	5	6
	(Wastes/Roads & Rlys/ (gravel pits etc.	15	8	8	4	11

Text Table 2. Percentage occurrence of different land uses by motorways. From maps of the Second Land Utilisation Survey of Britain (indirect records). Data taken at every grid line (approx. 1 km intervals on the road).

Land use	M1 Map 287 Harpenden 11 km	M5 Map 281 Gloucester 11 km	M6 Maps 558 and 515 Stafford / Stoke 19 km	M6 Maps 713 and 724 Lancaster/Grange 21 km	A1(M) Map 654 Doncaster 11 km	A1(M) Map 801 Durham 11 km	Average from all data weighted for different lengths of individual samples
Crops	59	22	10	5	40	34	34
Grass	5	47	63	66	14	37	37
Woodland	0	0	8	5	9	10	9
Wildlife habitats	19	12	13	21	14	12	11
Non-wildlife habitats	19	19	5	3	23	7	10

CHAPTER 4

GRASS AND HERBACEOUS PLANTS

A. Establishment of grass

After the construction of earthworks it is desirable to establish a grass cover as soon as possible so as to avoid erosion. For this purpose a standard grass and clover mixture is sown by the contractors, often some months before the carriageway itself is laid, or the motorway opened to traffic. There is no general rule specifying the season when seed should be sown, but as contractors have a responsibility to re-seed if the first sowing fails, the work is likely to be carried out under reasonably favourable conditions. On the other hand, contractors (who are usually responsible for cutting grass during the construction period of the motorway), will on occasions delay sowing as long as possible in order to avoid the expense of grass cutting.

Specifications for preparing the ground, adding fertilizers and sowing are contained in the official 'Specification for Road and Bridge Works' (HMSO 1969). These are used as a basis in the preparation of contracts. Clearly it is not possible to be very precise in a contract about the exact soil tilth to be achieved, nor the weather conditions, nor time of year at which seed shall be sown. Basically the contractor is required to lay topsoil to a specified depth, usually ten cms (four ins), and subsequently to apply a suitable fertilizer or fertilizer mixture before sowing a grass/clover mixture containing:

Lolium perenne (Perennial Rye grass) S23	27.25 kg	60 lb
Festuca rubra (Red Fescue) S59	9.0	20
Poa pratensis (Smooth Meadow grass)	9.0	20
Cynosurus cristatus (Crested Dogs tail)	9.0	20
Trifolium repens (White Clover) S100	4.5	10
	50.75	112

This mixture is sown at a rate of 454 gms per 75 square metres (16 ozs per 90 square yards, approx 1/5 oz/sq yd) on flat verges and central reserves, and 454 gms per 50 square metres (16 ozs per 60 square yards, approx $\frac{1}{4}$ oz/sq yd) on side slopes.

The specifications indicate that stones and other debris, above a minimum size, are to be removed so as to avoid subsequent damage to grass cutting machinery. This is less important now as flail machines are not so prone to damage as the cylinder mowers that were used at one time. However, besides damage to the machine, a danger exists with some mowers, notably those with horizontal rotary cutters having fixed blades, where loose stones can be hit and flung out of the back of the machine with considerable force.

Details are also given in the specifications for turfing, but because of expense significant areas of grass are unlikely to be established in this manner on motorways. Hydraulic mulch seeding (hydro-seeding) is sometimes used, where a mixture of seed, organic material (with or without fertiliser), and mulch or other additions, are sprayed onto an area. There are various commercial variations of this technique which are particularly useful for seeding difficult ground, steep slopes, rock cuttings (where desired) and other places inaccessible to more conventional methods. Because all the elements required for germination and initial establishment are contained in the mixture, hydro-seeding is also useful for places where soil preparation and soil quality are inadequate.

The application of fertilisers is specified to aid initial establishment of grass, but their use subsequently is not recommended. Likewise, for the first two seasons after establishment a moderately intensive programme of mowing was prescribed (in instructions issued by DOE to Agent Authorities but altered in 1975 - see Chapter 6), in order to encourage the development of a dense, weed-free sward. During the establishment period selective weedkillers may still be used with the Department's permission.

Non-standard seed mixtures have been used in some special areas and examples of these are to be found on a) the M3 for one mile where it crosses Chobham Common, b) the M40 from approximately Junction 5 to the B4009 crossing (about two miles) where a special Chalk grassland mixture was sown in the area where the Chiltern scarp is crossed, c) on the Pennine stretch of the M62 where a moorland mixture (see Text Table 3) was used, d) on the M2 in Kent on the chalk cutting immediately south of the Medway crossing where Sainfoin (Onobrychis viciifolia), and other calcicolous herbs were included. In these instances changes were made in the hope of establishing vegetation more appropriate to the area than that of the standard mixture. However, none of these alternatives have been used extensively, and the standard rye grass mixture has been almost universally sown.

The initial seeding of motorway areas has usually been satisfactory (although occasionally reseeding has been necessary), and erosion has been controlled. No vegetation cover can be expected to control slip erosion caused by an instability in the soil subsurface profile, but if a reasonable cover is established gully and surface erosion are minimised. With poor cover, isolated plants may themselves be the focus for the start of gully erosion.

Contractors are usually liable for the maintenance and making good of Trunk Road motorways for a 12 month period after completion, but this does not include grass mowing. At the end of this time the motorway is handed over to the Agent Authority by the Department of the Environment. In some instances, however, Agent Authorities have insisted that the contractors make at least one cut before handing over, partly to ensure that stones and debris have been properly collected. With Principal road (Local Authority) motorways other arrangements may be made, although general practice is likely to follow the national pattern.

Regardless of what is sown, the grassed areas (taken here as all earthworks including those subsequently planted with bushes and trees) are invaded sooner or later by wild plants. In most instances a grassland sward, bearing little relationship to the sown mixture, develops within five years. This is likely to contain a greater or lesser number of other herbaceous plant species depending upon management, sources of propagules and a range of edaphic and climatic variables (see also Chapter 3). It can therefore generally be argued from a floristic point of view that the composition of the original seed mixture is relatively unimportant, except in the earliest establishment phase.

B. Introduction of herbaceous plants

There is interest in encouraging the diversification of the flora of the motorway verges, and numerous proposals have been made for introducing the seeds of a range of additional species to the standard mixture. There are a number of difficulties, however, including expense and the lack of commercial quantities of suitable seed. As much of the seed of even 'wild flowers' is obtained from abroad, there are scientific and conservation fears about the introduction of non-indigenous genetic material. Thus, attempts have not been made to artificially introduce herbaceous wild plants on a wide scale on the motorways by seeding or by planting as part of the official policy.

Text Table 3. Special grass seed mixtures used on different stretches of Motorways.

M3
Chobham Common

5 kg	11 lbs	Poa pratensis (Smooth Meadow grass)
2.75 kg	6 lbs	Agrostis tenuis (Common Bent)
25.5 kg	56 lbs	Festuca rubra ssp rubra (Red Fescue)
10 kg	22 lbs	Festuca ovina (Sheep's Fescue)
5 kg	11 lbs	Agrostis canina ssp montana* (Brown Bent)
2.75 kg	6 lbs	Deschampsia flexuosa (Wavy Hairgrass)
51 kg	112 lbs	

* unobtainable, Agrostis stolonifera (Creeping Bent) used instead.

M40
Chiltern Scarp

14%	Festuca ovina (Sheep's Fescue)
14%	Poa pratensis (Smooth Meadow grass)
14%	Festuca rubra ssp rubra (Red Fescue)
14%	Agrostis tenuis (Common Bent)
6%	Trifolium campestre (Hop Trefoil)
5%	Trifolium repens (White Clover)
5%	Trifolium pratense (Red Clover)
14%	Onobrychis sativa (Sainfoin)
14%	Poterium sanguisorba (Salad Burnet)

Anthyllis vulneraria (Kidney Vetch) and Lotus corniculatus (Birdsfoot Trefoil) were originally specified but were unobtainable.

M62
Pennine mixture

22.75 kg	50 lbs	Deschampsia flexuosa (Wavy Hairgrass)
16.75 kg	37 lbs	Festuca ovina (Sheep's Fescue)
12.25 kg	27 lbs	Festuca rubra S59 (Red Fescue)

Nevertheless, some wild species have been planted on a restricted scale: in two instances when attempting to establish 'safe' colonies of endangered plants for conservation purposes, and in a third for generally diversifying the flora and adding to public amenity.

Leicester M1	Aquilegia vulgaris (Columbine)
Nottingham M1	Crocus nudiflorus (Autumn Crocus) C. purpureus (Spring Crocus) Aquilegia vulgaris (Columbine) Polemonium caeruleum (Jacob's Ladder) Tulipa sylvestris (Wild Tulip) Narcissus pseudonarcissus (Wild Daffodil) Campanula latifolia (Giant Bellflower) Digitalis purpurea (Foxglove) Fritillaria meleagris (Fritillary) Primula veris (Cowslip) P. vulgaris (Primrose)
Hereford & Worcester M5	Ulex europaeus (Gorse) Sarothamnus (Cytisus) scoparius (Broom) Thymus serpyllum (Breckland Thyme) Campanula rotundifolia (Harebell) Erica cinerea (Bell Heather) Calluna vulgaris (Heather) Digitalis purpurea (Foxglove) Primula vulgaris (Primrose) Carum carvi (Caraway) Achillea millefolium (Yarrow) Chaerophyllum temulentum (Rough Chervil) Poterium sanguisorba (Salad Burnet)

In the examples given above all the plants were established from seedlings raised elsewhere, their subsequent establishment being treated as a small scale horticultural operation. However, gorse and broom are easy to establish from seed, and would be especially suitable for including in mixtures sown by hydro-seeding. Heather and ling, which might also be thought to be suitable species for this technique have not, in practice, been found to be very successful.

An account of the natural invasion of plants into grassed and planted areas along the M1 (arising from a survey in 1970) is to be discussed in a subsequent report. Botanists have not otherwise had an opportunity to study the natural invasion of these areas except for general observations on the natural spread of gorse and broom on the M20 in Kent, the M1 in Bedfordshire and elsewhere; of cowslips, primroses and bluebells in some areas; and the widely publicised colonies of Wild Daffodils on the M50 in Hereford and Worcester.

When asked about their attitudes to planting wild flowers in grassed areas along motorways, seven (Bedfordshire, Derbyshire, Leicestershire, Nottinghamshire, Wiltshire, Hereford & Worcester, South Yorkshire) of the 29 Authorities visited were sympathetic to the idea, and a further eight were sympathetic with reservations about the practicability of any proposals. None were opposed and the remainder felt that they would wish to be guided by the Department of the Environment, without having any particular views themselves. Disquiet usually centred on how and by whom the plantings were to be made, rather than what was to be done. Several Councils were concerned that an exercise of this sort should not involve them in any additional maintenance commitment. There were fears expressed by three or

four Councils about drivers being distracted by the sight of wild plants, or of travellers stopping on hard shoulders to view or pick them. On the other hand, a number of Authorities thought that colourful stands of plants would break the monotony of the motorway and actually make driving safer; also that the people who picked plants mostly climbed over boundary fences or at bridges to do so. It was suggested that planting sites should be selected where it was difficult for people from outside the motorway to gain access in this way.

CHAPTER 5

PLANTING AND MAINTENANCE OF TREES AND SHRUBS

The Ministry of Transport, and since 1971 the Department of the Environment, have been responsible for the planting of very considerable numbers of trees and shrubs by motorways (Text Tables 4 and 5). These purely amenity plantings have been described as the most extensive of their kind since the great landscaping period of the 17th and 18th centuries. As we, in the 20th century, are now benefiting from the designs of 100 to 200 years ago, so it is to be expected that the greatest effects of motorway plantings made over the last 16 years will be apparent in two or three generations time. Nevertheless, some of the older plantings on the M1 and the M6 are already beginning to give an extra dimension to the shape of the motorway corridor.

Text Table 4. Annual total numbers of trees and shrubs planted by motorways 1963/64 to 1973/74 (detail from DOE records).

1963 - 64	402,328
64 - 65	419,711
65 - 66	529,133
66 - 67	568,918
67 - 68	597,537
68 - 69	816,899
69 - 70	844,114
70 - 71	1,162,311
71 - 72	1,221,499
72 - 73	1,602,645
73 - 74	1,596,653
Total	9,761,748

The purpose of this work extends beyond the straightforward establishment of trees along roadsides. The plantings are designed to merge the inevitable linearity of the motorway (the scale of motorway construction makes this particularly apparent) into the contours of the countryside. They are also designed to break up the line of a motorway, especially when it is on embankment, as seen from the surrounding countryside; to soften the sometimes hard appearance of bridges and structures, and to hide ugly places both on and off the route. In addition, shrubs and trees are claimed to have a value in deadening the noise of traffic, so that proposed plantings (together with other earthworks) are often an important consideration in the choice of the line for a motorway, especially in built-up areas.

In the design of planting schemes and choice of species to be used, the Ministry of Transport, and later the Department of the Environment, have been advised by the Landscape Advisory Committee (see Chapter 1). The composition of the Committee has gradually changed over the years, reflecting its changing interests from the details of landscaping new projects, to environmental considerations on a much wider scale. In the past the Committee has been a prime mover in establishing the principles and practices of motorway tree and shrub planting and if it now spends less time on horticultural and silvicultural discussion, this is largely because these principles and practices have been established. The Committee still maintains a general interest in planting schemes and makes regular inspections, especially in areas where difficulties in tree establishment or other problems have arisen. It has close contact with the Department's Landscape Architects, and the professional Horticultural Advisor (an appointment dating from 1947), who is the officer responsible (inter alia) for the detail of planting plans, and for contracts for the supply and planting of material.

Text Table 5. Numbers of trees and shrubs planted along motorways during the seasons 1971/72, 1972/73 and 1973/74 (detail from DOE records).

Trees		Bee plants	Alien	
Acer campestre	Field Maple	B		313,959
Acer platanoides	Norway Maple	B	A	24,889
Acer pseudoplatanus	Sycamore	B	A	521,924
Aesculus hippocastanum	Horse Chestnut	B	A	4,300
Aesculus indica	Indian Horse Chestnut	B	A	3,000
Alnus cordata	Italian Alder	B	A	2,110
Alnus glutinosa	Alder	B		142,735
Alnus incana	Grey Alder	B	A	136,564
Betula pendula	Silver Birch	B		286,037
Carpinus betulus	Hornbeam	B		15,728
Castanea sativa	Sweet Chestnut	B	A	8,397
Fagus sylvatica	Beech	B		143,621
Fraxinus excelsior	Ash	B		255,978
Larix decidua	European Larch		A	6,300
Larix x eurolepis	Hybrid Larch		A	95,106
Larix (leptolepis) kaempferi	Japanese Larch		A	125,299
Pinus contorta var contorta	Shore Pine		A	3,980
Pinus nigra var maritima	Corsican Pine		A	16,360
Pinus nigra var nigra	Austrian Pine		A	5,802
Pinus sylvestris	Scots Pine			378,633
Populus 'Clone 32'			A	1,271
Populus nigra 'Italica'	Lombardy Poplar	B	A	164
Populus serotina			A	1,913
Pseudotsuga menziesii	Douglas Fir		A	4,060
Quercus ilex	Evergreen Oak		A	2,140
Quercus robur	Pedunculate Oak	B		144,188
Robinia pseudoacacia	Acacia	B	A	5,834
Sorbus aria	Common Whitebeam	B		3,946
Sorbus aucuparia	Rowan	B		18,110
Taxus baccata	Yew	B		7,858
Tilia cordata	Small-leaved Lime	B		
Tilia euchlora	Caucasian Lime	B	A	244
Tilia platyphyllos	Large-leaved Lime	B		1,107
Ulmus carpinifolia sarniensis	Guernsey, Jersey or Wheatley Elm		A	501
Ulmus glabra	Wych Elm			42,297
Ulmus procera	English Elm	B		80,192

Text Table 5 continued.

Understorey trees, shrubs and bushes		Bee plants	Alien	
(Cornus) Swida sanguinea	Dogwood			12,329
Corylus avellana	Hazel	B		148,365
Cotoneaster bullatus		B	A	1,630
Cotoneaster lactea		B	A	1,198
Crataegus monogyna	Hawthorn	B		801,553
Crataegus (oxycantha) laevigata	Midland Hawthorn	B		7,730
Euonymus europaeus	Spindle			1,825
Genista hispanica			A	1,250
Hedera helix	Ivy	B		3,425
Hypericum calcyinum	Rose-of-Sharon		A	9,656
Ilex aquifolium	Holly	B		30,385
Ligustrum ovalifolium	Garden Privet		A	2,764
Ligustrum vulgare	Wild Privet	B		11,060
Prunus avium	Wild Cherry			25,316
Prunus avium 'flore pleno'			A	103
Prunus spinosa	Blackthorn	B		101,345
Pyracantha coccinea			A	1,760
Rhododendron ponticum	Rhododendron	B	A	4,770
Rosa canina	Dog Rose	B		14,959
Salix alba	White Willow	B		35,318
Salix caprea	Goat Willow	B		161,312
Salix cinerea	Grey Willow	B		47,793
Salix fragilis	Crack Willow	B		3,753
Salix pentandra	Bay Willow	B		4,991
Salix viminalis	Osier	B		7,829
Salix vitellina var pendula	Weeping Willow	B	A	3,794
Sambucus nigra	Elder	B		83,126
Sarothamnus scoparius	Broom			4,615
Ulex europeaus	Gorse	B		3,650
Viburnum lantana	Wayfaring Tree			13,020

The principle of planting only indigenous species of locally occurring trees and shrubs on rural stretches of motorway has been well established. Although non-indigenous species are not generally set, some decorative trees and shrubs may be used in close proximity to residential property and in urban areas. However, where a motorway passes through a woodland that itself contains exotics, exceptions have been made. Thus on the M4 in the area of the mixed deciduous and coniferous woodland of the Yattendon Estate, Douglas Fir (Pseudotsuga menziesii), Western Red Cedar (Thuja plicata), Western Hemlock (Tsuga heterophylla) and Deodar (Cedurus deodara) have been included in the planting plan.

In accordance with woodland practice, nurse species such as hazel, willow, poplar, alder and conifers have been extensively planted, and are usually the most obvious trees to be seen at the present time. It will be 20 to 50 years before they are replaced by the forest trees that have (in many instances) been planted amongst them. It is intended that the nurse trees should be thinned out at the appropriate time, whilst losses of the climax species should be made good as the opportunity arises, to give the required density and spacing in the long term. Some natural regeneration of species can be expected, which will produce desirable variations in age of the tree stand, although the survival of seedlings will be at great risk from small mammals, fire, and other natural causes.

Basically three planting arrangements for trees have been used on motorways:-

(a) Close planting (1.5 m) in mixed plantations of trees about 50 cms tall, and two to three yars old.

(b) Open planting of larger material, usually staked.

(c) Planting of individual specimens, always staked.

Most trees are now established in plantations or closely planted groups (category a), marked in the early stages by white posts, where there is no mowing or other management by the County Council Highway Agent Authorities. Some Councils resent these areas (with or without reason) as being untidy, as litter traps and as potential fire hazards, but nevertheless their management is left to the Department of the Environment's Planting Agents (see below).

Pedestrian or tractor operated mowing machines have been used in many counties to cut grass among the formerly more often planted, widely spaced, trees in categories (b) and (c). In many instances individual trees have been damaged as a result of these operations, although it is not possible to say to what extent this has contributed to plant failures. In more recent years many Councils have either instructed their operators to be more careful, or organised special horticultural gangs for management among trees, or have avoided mowing in the area of trees altogether (see Chapter 7). With the recent instruction to cease mowing grassed areas (Chapter 6), the danger of damage to these plantings by machinery will be diminished, although the increased danger of fire has emerged as an alternative hazard.

The Forestry Commission are the principle Agents for tree and shrub planting on motorways. In Warwickshire, commercial contractors have been responsible for sections of the M6 Midland Link, and in Wiltshire for sections of the M4. The plantings on the earliest sections of the M1 were made by commercial contractors but have been subsequently replanted by the Forestry Commission. In general the giving of contracts to the horticultural industry has been very much the exception and the Forestry Commission has been responsible for most plantings since 1961. However, in Kent (M2 and M20), Lancashire (M6, M61, M62), Leicestershire (M1), and West Yorkshire and South Yorkshire (formerly the West Riding) (M1 and A1(M)), the County Councils have been responsible for plantings (always to DOE plans),

using plant material either grown themselves or provided by DOE. These five Councils are also the DOE's agents for the management of the planted areas. Otherwise the planting and management of trees and shrubs by motorways has been contracted out by the Department of the Environment to the Forestry Commission in perpetuity, and this is the understanding of the majority of Agent Authorities concerned. Thus, in most counties the management of trees and herbaceous vegetation in the plantations are not the responsibility of the County Councils, and these places are effectively 'no-go' areas for them.

Management in 1974 by the Forestry Commission was mainly concerned with weeding and restaking, and of replacing individual plants that had failed to establish. Weeding might be by hand or by use of herbicides. Despite more serious competition from ground vegetation, small trees (category (a) above) generally established more successfully than larger subjects.

Taking into account the very difficult soil conditions sometimes encountered on newly-formed earthworks, the general consensus of opinion from the counties was that trees and shrubs planted by motorways were establishing satisfactorily. The positive advantages of the plantings were appreciated. They were not considered to be a safety hazard; in some counties experience suggested that trees on embankments held up vehicles from accidents that might have been more serious if the vehicles had gone on straight to the bottom.

It should perhaps be re-emphasised that the silvicultural and management problems of establishing trees and shrubs in the frequently unfavourable soil conditions associated with motorways are being continuously studied by the Department of the Environment, and the Forestry Commission as their main planting agents. In addition, informed and objective appraisals of the success or otherwise of these plantings are made by the independent Landscape Advisory Committee, basing its judgements on past experiences over some 20 years of involvement.

CHAPTER 6

ANALYSIS OF REASONS FOR MANAGING GRASSED AREAS ALONG MOTORWAYS, AND ATTITUDES TOWARDS THEIR MANAGEMENT

It is important to emphasise (see Chapter 1) that motorway trunk roads are paid for and are the property of the Department of the Environment (DOE). This being so, the Department is entitled to say how the money allocated to motorways should be spent, and (specifically within the title of this chapter) how motorways should be maintained. This is done by publishing Technical Memoranda or Technical Instructions from time to time on particular topics, and by personal liaison between officers of the Department and those of the maintaining Authorities.

At the time of writing in August 1975 a new Technical Memorandum (H.9/75) has recently been issued entitled "Grass Cutting and Hedgerow Treatment on Trunk Roads and Motorways". This replaces the previous memoranda H.4/71 (referring to vegetation on Central Reserves) and H.11/73 on "The establishment and maintenance of grassed areas on Trunk Roads and Motorways". Technical Memorandum H.11/73 was the instruction in force at the time of the survey on which this report is based, and the comments from the Agent Authorities that follow in Appendix Tables 6.1 to 6.4 refer to that Memorandum.

H.9/75 represents a departure from previous memoranda and instructs Agent Authorities to "leave the cutting of grass on land forming part of trunk roads and motorways as a general practice, except in certain restricted places and circumstances". This measure has been brought about by the need to save money and fuel, although it has also been controversially promoted as being in the interests of conservation. In most instances the exceptions will apply to non-motorway trunk roads and not to motorways, where, it is generally agreed, there are no highway engineering reasons for grass cutting except in the immediate neighbourhood of the carriageways, for access, and in some places to create fire breaks. Thus the immediate prospect for the next two or three seasons, while the effects of these instructions are assessed, will be for there to be no mowing of established grassed areas by motorways.

It is evident that such a simple programme will be easier to supervise than the previous instructions, which gave a good deal of latitude to Agent Authorities. It will be seen from Appendix table 6.1 that some took an independent and often a proprietorial view of the motorways for which they were responsible, and wished for prestige and other reasons to maintain to much higher standards than were called for. On the other hand there were those Authorities who were entirely ruled by the Departmental instructions. Between these two, the majority were concerned to maintain grass to an acceptable standard (that is one that escaped public criticism) at a reasonable level of cost, usually taking the Technical Memoranda as a useful guide.

Because County Councils, representing the Agent Authorities, had a wide range of policies and programmes of grass management likely to be of interest in relation to the development of a "motorway flora", their reasons and policies for management in 1974, as explained to the author, have been analysed (Appendix Tables 6.1, 6.2 and 6.3):

a) Highway factors (Appendix Table 6.1). These included the need to reveal structures and street furniture, ditches, drains and fences for inspection purposes, and to provide access to them. The maintenance of drainage ditches and apparatus was seen as an important function of grass cutting by 10 of the 29 Authorities. The occurrence of fire, although recognised as a risk where there were areas of uncut, dried-up vegetation, was so unpredictable that most Authorities did not see it as an economic reason for grass cutting. However, in arable districts the provision

of fire breaks to prevent the spread of fires from straw and stubble burning in adjoining fields, was seen as a wise precaution. Apart from these detailed considerations and the need to maintain sight lines in the vicinity of slip roads, at interchanges and junctions, the consensus of opinion was that there were no highway engineering reasons for the general cutting of grass on the main areas of motorway banks and verges.

b) Amenity and Agricultural factors (Appendix Table 6.2). All Authorities were concerned to some extent about amenity aspects of grass mowing; some had more money available than others for this purpose. Attitudes towards the concept of amenity were opposed, even in the same office in some instances. In a number of Authorities greater emphasis was placed on maintaining a more intensive standard of management in the neighbourhood of built-up areas than elsewhere.

All the Authorities were conscious of the provisions of the Weeds Act 1959, and most were concerned in any case to control agricultural weeds on motorway land in a spirit of good neighbourliness towards adjoining farmers. However, the control of weeds was not, in most cases, given as a reason for grass cutting generally. Individual stands of prescribed weeds were likely to be controlled on a local basis, usually by the application of spot treatments of appropriate herbicides. As on previous occasions (Way, 1973), it was found that there were different interpretations of the definition of a weed, and sadly that some Authorities still persisted in considering any plants other than grasses as undesirable.

c) Conservation (Appendix Table 6.3). Various degrees of interest were expressed. It is probably a fair assessment (with some notable exceptions) that the attitudes were more often negative, in the sense of being interested so long as no action was required. There is no reason why biologists should expect engineers to have more than a passing interest. However, in so far as the engineers are the managers of the land, it is important for them to have their interest aroused if the best biological use of the land is to be obtained. Whilst it may be a value judgement that is difficult to support in economic terms, it can be considered (in the absence of any other declared uses for the land) that nature conservation is a best use of the 13,000 or so acres involved (Chapter 2). If this were to be generally accepted (rather than exceptionally) then it would be easier to explain and put into practice management policies that were optimal for wildlife. In the meantime the Department of the Environment's instruction to leave all mowing will probably not be the best management for the creative conservation of herb rich grassland, and flowering plants, foreseen by Clough Williams-Ellis (op. cit., see Chapter 1).

Table 6.3 also gives details of deaths of animals on motorways. A frequent observation was made that there were more deaths of wild animals (and dogs and cats) on the County rural roads than on the motorways. A number of reasons for this might be proposed connected with the density of traffic as a deterrent to animals, together with noise and other disturbance. There cannot be much doubt that for small mammals, flightless insects, frogs, toads and other groups, a full six lane motorway is a substantial barrier to movement (Oxley et al, 1974). Two possibilities are open in connection with the high numbers of casualties in the early period after a new motorway is opened, followed by the decline in the numbers killed later. Either the populations have been so reduced after the initial period that the drop in numbers reflects the drop in the population, or, that the majority of animals have a) learned to avoid the carriageway by using culverts, bridges and other safe crossings, b) acquired traffic sense, c) changed their habits or territories so that they no longer need to cross. Reliable, objective studies have not been made of the effects on neighbouring animal populations of the opening of a motorway, although some information is available about badgers (Clark, 1973; Jefferies, 1975). The important question is concerned with the survivors, not those killed. That is, how many breeding pairs survive or are able to colonise motorway banks with a reasonable chance both for themselves and a proportion of their young to survive?

Thus, it is apparent from the reports that local populations of certain species suffer considerable losses during the early period after a motorway is opened. Later, the species most at risk may adjust differently, and a motorway fauna may develop, especially among mammals and birds, to include types adapted to the particular hazards of these roads.

Replies of Agent Authorities are summarised in Appendix Table 6.4 to two hypothetical questions (at the time of asking) a) given unlimited resources would they wish to intensify grass management; and b) what would their reactions be to an instruction to stop grass cutting altogether? In response to the first question most Authorities appeared to be satisfied with the level of management achieved in 1974 (see Chapter 7) and did not think that higher standards were required. There was very little public comment in 1974 on the management of grass by motorways, and this could be taken as acceptance by the public of the mowing that had been done.

To the second question, 20 Authorities thought that they would object on grounds of fire risk, obscuration of signs and denial of access, that is on the highway (as opposed to the amenity) reasons given in Appendix Table 6.1 Eight Authorities thought that they would be glad to be instructed to stop mowing so that they could do so on the Department of the Environment's responsibility, and so be able to devote their resources to more urgent works. Both responses represent a considerable change to the previous views held by a number of Councils, where anything other than quite a high standard of management would have been thought to show neglect and lack of pride in the management of the motorway as a whole.

CHAPTER 7

MANAGEMENT OF GRASSED AREAS ON MOTORWAY BANKS AND VERGES IN 1974

The information given in Appendix Table 7.1 is now of historic interest, as it represents the furthest stage in the evolutionary process of devising acceptable programmes of grass management, before the Department of the Environment placed an embargo on most grass cutting by Agent Authorities in 1975. Appendix Table 6.4, indicates that most Authorities thought that their 1974 programme was the minimum acceptable, although some were prepared to forgo the amenity aspect of cutting in the future, providing the responsibility for the decision was taken by the Department of the Environment.

In 1974 most programmes were intended to manage part or all of the flat areas behind the hard shoulder by cutting two or three times, to mow cutting slopes once or twice, but to leave embankments uncut except where they were in full view of built-up areas, or considered likely to produce a weed problem. In Avon, Co. Durham, Gloucestershire, Hampshire, Hertfordshire and Gwent the grass growth retarder Maleic hydrazide (MH), with or without 2,4-D, might be used; all other Authorities used machines exclusively for control of growth although most Authorities used a limited range of herbicides for local spot application to control weeds.

In Cheshire, Derbyshire, Co. Durham, Gloucestershire, (Hampshire in the establishment phase of the M3), Kent, (Somerset in the establishment phase of the M5), and Warwickshire, all the grassed areas were cut. In comparison, in Avon, Bedfordshire, Buckinghamshire (M40), Hereford and Worcester, Hertfordshire, Wiltshire, and Gwent, there was no general mowing of slopes, whether cuttings or embankments, in 1974.

Most Authorities used rear mounted flail machines on the flat but there was a strong division of opinion about the most efficient and safest machine to use on slopes, where operations could be difficult and sometimes dangerous in wet weather. Machines in use included rear mounted flails on specially adapted low centre of gravity tractors; side arm flails reaching anything up to 23 ft in an arc from the tractor, and a range of small ride-on rotary mowers of different kinds designed for use on banks. In addition all Councils had a number of pedestrian operated machines (usually of the rotary type, but including both cylinder and flail models) for work in restricted areas, especially round structures and at interchanges/junctions inaccessible to the larger machines.

As noted above, most Authorities used selective herbicides for local application to stands of weeds considered to be injurious. The most commonly applied compounds were commercial formulations of 2,4-D, dicamba, picloram and asulam. In addition total herbicides were used for control of vegetation around structures and furniture (including crash barriers), and for cleaning French and other types of drains. The materials included mixtures (some containing the selective herbicides 2,4-D or MCPA) of simazine, atrazine, monuron, diuron, picloram, paraquat, aminotriazole, chlorthiamid, dichlobenil, borax or sodium chlorate. Dalapon was used against bulrushes (Typha spp.) in ditches in Wiltshire as a result of police complaints about motorists stopping to pick the plants. No particular preferences for sprays as against granular formulations were expressed by the engineers. Granular applications, with their obvious advantages of not drifting, and of not requiring cartage of water, performed quite satisfactorily where they were used, although some lack of persistence on banks was noted in Hertfordshire.

CHAPTER 8

DITCHES, DRAINS, HEDGES AND FENCES

Ditches and hedges provide additional wildlife habitats to the main grassed and planted areas, but pipes, drains and fences are comparatively sterile.

Ditches and Drains

The disposal of surface water from carriageways, and ground water from earthworks, are among the most important engineering considerations in highway maintenance. Although the routine management of ditches and drains may not be costly, engineers are concerned to ensure their efficient working (Appendix Table 8.1), and particularly:

1. to prevent surface vegetation and roots interfering with the passage of water through French and rubble drains.

2. to prevent vegetation growing on the sides and bottom of open ditches interfering with the free flow of water, but nevertheless to encourage plants that hold the ditch sides together and prevent erosion.

3. to prevent the silting-up of ditches and drains where there is insufficient scouring, usually as a result of inadequate falls.

Fences

The provision and maintenance of a boundary fence on motorways is a specific obligation on the Highway Authority, unlike the situation on all other kinds of road, where the obligation is on the neighbouring landowner. On motorways stock-proof fences are erected even in areas where stock are not usually kept, but if there is a change to stock, the obligation is on the landowner to provide any additional fencing or netting that is necessary. While a wooden post and four or five rail fence is the standard provision, other types may be seen. Thus in urban areas, by schools, golf courses and local specialised land uses there may be wire mesh fences to prevent trespass. Close boarded fences are used to block out the sight of motorways, and some fences have been specifically designed to reduce motorway noise (e.g. on sections of the M6 near Birmingham) in built-up areas. In hunting districts additional height of fencing may be erected (e.g. as by the Beaufort Hunt on the M4 in Wiltshire) to prevent hounds running onto the motorway.

Various designs of metal post and wire or welded mesh fence have been erected. On the Pennine section of the M62 in West Yorkshire, and the Chobham Common section of the M3 in Surrey, metal fences have been erected in areas where post and rail would be inappropriate in the landscape (the M62 fence has also been designed to control drifting snow). On the M5 in the Bridgwater area of Somerset an experimental plastic coated fence has been used. It is possible that metal or plastic may be used more in the future to replace wooden fencing.

Hedges

Hedges were provided in the original specifications for motorway construction. They can be seen by the M1 in Bedfordshire, Buckinghamshire, Northamptonshire and Leicestershire; by the A1(M) Doncaster By-Pass (previously in the West Riding of Yorkshire); by the M5/M50 in Hereford and Worcester; between Junctions 5 and 7 on the M4 in Berkshire; also by stretches of the M6 in Staffordshire, Cheshire, and the Lancaster and Preston By-Passes in Lancashire. Hedgerow planting as part of the general provision for motorways was apparently discontinued in about 1965. It appears from Appendix Table 8.2 that there are approximately 576 km (360 miles) of hedge or about 16% of the potential motorway boundary length (doubling the mileage

of motorways to give both sides). Further lengths may be associated with slip roads, junctions and feeder roads as part of the accommodation works, but details are not available.

Management

a) Drains. A range of total herbicides for controlling vegetation on the surface of French and rubble drains is available, but the more persistent materials are necessary to kill roots that have penetrated deeply. Most, but not all, County Councils do use herbicides, and it is considered that herbicides are perfectly proper 'tools' to use in these situations. Access to drains is usually adequate, although crash barriers may obstruct the work on central reservations.

Piped ditches and drains do not really have problems associated with vegetation, although they may be affected by silting. There is a division of opinion among engineers on the benefits of piped drains versus open ditches (Appendix Table 8.1).

b) Ditches. Access to ditches for maintenance is not always adequate. As a result some vegetation control has to be done by hand tools. There was no mention in the engineer's replies about the use of small hand held man-pack or remotely (e.g. by air line) powered machines.

In most instances, however, side arm flails are used. Herbicides are not applied extensively, partly because of the risk of contaminating down-stream watercourses, and partly because there is a need to conserve the erosion control properties of the vegetation. Where both silting and plant growth are causing a problem, a ditching machine is likely to be used (when there is access) in order to solve both problems at once.

c) Fences. There is very little vegetation management in connection with fences. Reasons for management include control of agricultural weeds, reduction of fire hazard and general tidiness. Maintenance of the fence itself is a question of routine inspection and patching as required. Some costs are given in Appendix Tables 8.2 and 8.3.

d) Hedges. Access problems for hedge management are complicated by the need to manage from the neighbouring landowner's side as well as the motorway side. The problems of access over neighbouring land were seen by many Agent Authorities as a major disadvantage of hedges (Appendix Table 8.2). However, in some counties (e.g. Hereford and Worcester, Lancashire) farmers had themselves done some of the hedge cutting, and in one or two instances (e.g. on the M50, Ross Spur) lengths of hedge had been particularly well cut and laid by the farmers. The general problem is not necessarily one of obstruction by landowners, but more often because the engineer's work programme rarely fits in with the agricultural year, and access for hedge management might be needed across land at an inconvenient time when crops are growing.

Hedge management has not been consistent throughout the areas where they occur, and the recent policy document H.9/75 from the Department of the Environment (see Chapter 6) will have the effect of further restricting their management. As noted above, most lengths of hedge are on the older sections of motorway (M1 to Crick, M6 north of Birmingham, M5/M50 Ross Spur) and some of these are at an age where they should be cut and laid for the first time, if this is the type of management chosen for them. In some counties (e.g. Bedfordshire, Northamptonshire, Staffordshire, Hereford and Worcester), some hedges have been laid, or arrangements to do so were being considered prior to the issue of the Department of the Environment's instructions (see above).

Management programmes involving cutting and laying on a 14 year cycle have been criticised for being expensive and requiring rare craft skills. Possibly too much emphasis has been placed on the craft of hedge laying, so that now there is almost a mystique attached to the work. A generation ago practically any farm worker could make an adequate job of cutting and laying, and the skills have neither been lost (Brooks, 1975), nor are too difficult to learn (prize winning championship quality of work may be another matter). A further criticism which applies to any form of management where mature wood is cut, concerns the disposal of cuttings, which cannot generally be burnt by motorways for safety reasons.

However, alternative forms of management are available. The simplest of these involves the annual trimming of softwood growth by machine to produce a hedge of triangular cross-section. A hedge of this sort can be managed by the tractor remaining on one side only with any of the cutting appliances available that have a "reaching-over" capability. There is no need to collect up the soft wood cuttings which will disappear naturally.

Where there is no access for tractor borne machinery, there are still possibilities for the use of the various kinds of mechanically or electrically powered hand-held hedge cutting tools that are available.

Besides annual trimming, some weeding of hedge bottoms is necessary for the growth of the hedge. The most efficient way to do this is by hand, but cutting machines or chemical growth retarder/herbicide combinations properly applied, provide an adequate control.

Comparison between Fences and Hedges

The majority, but not all, of Agent Authorities did not welcome the idea of boundary hedges by the motorways (Appendix Table 8.2). The principal arguments were:-

1. Lack of money and of labour with specialist skills for management of hedges.

2. Lack of access for machines on the motorway side.

3. Difficulties of access over neighbouring land.

4. Problems of disposal of trimmings and larger woody cuttings.

5. Difficulty of repair after damage, compared to fences.

6. Difficulty of guaranteeing that hedges were 100% stockproof.

7. Requirements for access to boundary ditches, and that the effectiveness of ditches might be affected by hedge growth.

A number of these points have been considered already, or are discussed in Appendix Table 8.2. Many of the others would be resolved by the thoughtful siting of hedges so as to avoid situations a) where they would be inaccessible for management, b) where there were particular dangers of their being damaged in vehicle accidents, or c) might affect the function of ditches.

There are, however, a number of advantages of hedges that need emphasising. The most important of these is that they are a self-renewing resource whose asset value (as a barrier, an amenity, and for wildlife) increases with age under reasonable management. In contrast, the materials used for wooden fences are becoming scarcer, more expensive, and of less certain quality.

In Appendix Table 8.3, an analysis has been attempted of the comparative costs of fencing by itself (with periodic renewal), and of a first fence (erected at the time of construction of a motorway) with subsequent establishment of a hedge to replace the fence in due course. On the basis of the assumptions and figures used in these analyses it is clear, as might be expected, that a fence alone is cheaper over the first discount period. However, the advantage over the second discount period swings to the hedge (with barbed wire for additional stockproofing). Thereafter the advantage remains with the hedge.

The estimated saving of £175,000 per annum for 60 years from a hedge (Appendix Table 8.3), for 1763 km of motorway is c. 60% of the £300,000 (Appendix Table 11.1) that may be saved per annum by not cutting grass by motorways. This is a figure that must presumably be considered as significant.

There does, therefore appear to be a case for reconsidering the establishment of hedges along motorway boundaries, where other factors are not limiting, as:

1. Hedges are a viable economic proposition once the establishment phase is passed.

2. Hedge management problems do exist, but are not insoluble.

3. Fences are wasting assets and expensive on resources. Hedges are a self-renewing resource and a continuing asset as a boundary, for amenity and for wildlife conservation.

4. Although many Agent Authorities have raised objections to hedges, some (Gloucestershire, Lancashire, Staffordshire, Wiltshire, Hereford and Worcester, West Yorkshire - Appendix Table 8.2) expressed in 1974/75 an interest in the establishment of boundary hedges, or a liking for those already growing by motorways in their areas.

CHAPTER 9

CENTRAL RESERVATIONS

Central reservations on British motorways are a standard width of 4 m (13 ft) (HMSO, 1968), and only very exceptionally has it been possible to increase this. Examples occur on the M6 north of Tebay in Cumbria, on the M1 in Yorkshire (north of Sheffield), and the M62 in the Pennine sections. On the M5 south of the Avonmouth Bridge the carriageways are grade separated (i.e. run on different levels) where the motorway passes sidelong along the feature known as Tickenham Hill. Most central reservations now carry a median French drain, crash barriers, ducting for electrical services, lighting columns, and electronic traffic control apparatus. The ground tends to be heavily affected by salt spray from winter de-icing applications, and is doubly exposed to pollution from lead, and other pollutants associated with traffic and the carriageways.

Although wild plants and animals are found on the central reserves, these areas have not been considered in terms of wildlife conservation, nor have any proposals been made for them to be managed in such a way as to encourage wildlife. Apart from the considerations of space and pollution, they are isolated between two bands of fast moving traffic, which make them exceedingly unpleasant and often dangerous places on which to work. As a consequence the use of chemicals for controlling vegetation on central reservations of motorways has been recommended without qualification as to the possible effects on wildlife or amenity. Most Agent Authorities use MH (growth retarder) plus 2,4-D (weed killer) on central reserves and are generally satisfied with the results, although many find it necessary to cut the vegetation occasionally, but not necessarily on an annual basis (Appendix Table 9.1). In addition many Authorities use a total weedkiller in the immediate vicinity of the crash barrier itself, and also on the French drains. In an extreme instance in Buckinghamshire all the vegetation is supressed by the use of total weedkillers. However, in Lancashire, Leicestershire and Wiltshire there is no spraying, and the central reserves are cut by one or more machines, litter is collected, the carriageways are swept and drains are scavenged in one rather highly organised, co-ordinated, operation.

Central reservations are of considerable public interest, and are more frequently commented upon than other areas, because they often appear unsightly. Many suggestions have been made for the establishment of shrubs and trees for amenity, for the prevention of headlight dazzle at night, and to act as a barrier to prevent cross-over accidents. Designers have been as much aware of these possibilities as anybody else (e.g. Huizinga, 1967). However, so long as the availability of land for motorways is restricted, central reserves will remain too narrow for planting, whether for amenity purposes or otherwise. In addition, pollution, especially by salt, restricts the number of species suitable for establishment. The particular problem of salt tolerance is the subject of research at Imperial College, London under contract to the Department of the Environment (Thompson, pers. comm.), which suggests (notwithstanding previous comments) that the desirability of planting in the central reserves is still being actively considered.

CHAPTER 10

POLLUTION AND LITTER

The motorway environment can be polluted by a) "continuous occurrences", associated mainly with exhaust products from vehicle engines, with oil, rubber and rust from bodywork and tyres, and with the accidental or deliberate deposition of litter; b) "discontinuous occurrences", including the seasonal distribution of de-icing salt, and unpredictable spills of toxic materials following vehicle accidents.

CONTINUOUS Vehicle exhaust emissions contain a) Gases - mostly oxides of carbon, nitrogen and sulphur; volatile fractions of oil and unburnt fuel, and water vapour, b) particulate matter including smoke, carbon, oil and water droplets, c) lead compounds associated with anti-knock additives to fuel in petrol engines (e.g. Colwill, 1973). In Britain there have been no indications that any of these constituents other than lead and oil have any toxicity, or even nuisance characteristics, on rural motorways, although in urban areas there may be problems of smell. Nevertheless all the gaseous materials do add to the general level of atmospheric pollution, and under different climatic conditions in other parts of the world (New York, the Los Angeles conurbation), photo-chemical smog is associated with them.

Lead is emitted in both particulate and volatile forms (Colwill, 1973; Colwill & Hickman, 1973). It is thought that the volatile fraction is widely dispersed and that no pattern of 'fall out' is likely. Particulate lead is emitted in the form of lead bromide, bromo-chloride, or oxide dust (Perry, pers. comm.), usually of very small particle size. Nevertheless, these particles fall quite rapidly to the ground and are either splashed in wet weather, or carried by air currents in a predictable manner (Bevan et al, 1974) to roadside verges and banks. Exponential fall-off in the level of residues both in soil and vegetation have been demonstrated by many workers, and by the author (a long-term monitoring study of lead levels by the M1 motorway in Leicestershire - in prep.). Because of the presence of a buffer area represented by the 3.2 m (10 ft 6 ins) wide hard shoulder on motorways, it is likely that amounts in and on vegetation and soils may be lower than on roads without this buffer zone, but carrying the same density of traffic, although no work has been seen to test this suggestion. Residue analyses of motorway grass, from which hay might be made, indicate that almost everywhere vegetation has amounts of lead (much of which is superficially deposited) several times greater than the rather arbitrary level of 10 ppm fixed by EEC as the maximum permitted in stock feed.

Vegetation and soils within 2.5 metres of the hard shoulder are usually heavily contaminated with superficial deposits of other materials. These may have been washed or splashed off the carriageway, or blown off vehicles as with the substantial quantities of coal dust found by the M1 in Derbyshire. The deposits often contain a high proportion of mineral particles, but can be mixed with oil, rubber dust, corrosion products from vehicles (rust), and loose materials from the road surface. Drainage water from the carriageway may also be contaminated by any of these materials: the implications of this are discussed below.

Litter is not considered by the general public as pollution, but in so far as it is unpleasant and sometimes dangerous, this is clearly what it is. Agent Authorities have daily patrols along their sections of the motorways to clean debris from the carriageways where there is a hazard to traffic. However, much material is also blown, knocked and washed from the carriageway onto the verges and banks where it may be damaging to mowing machines, as well as unsightly, and sometimes hazardous to wildlife. Most Agent Authorities have periodic scavenging parties to collect this marginal litter to prevent it accumulating, but these are expensive and time consuming operations. No section of the community is blameless, but the greatest weight of material probably falls, or is blown, off open and flatbed lorries.

At the time of writing a nationwide publicity campaign under the title of SPIKEY, aimed at parents through their children, is being planned by a voluntary organisation with the intention of encouraging motorists to take their litter home, and specifically asking them to carry disposable bags in their vehicles for litter storage. This campaign is being supported by a wide range of interested government and non-government bodies.

DISCONTINUOUS Salt is used in large amounts on motorways (Ranwell et al, 1973) as a de-icing agent, and no substitute has been seriously suggested. In addition to necrosis resulting from direct applications to plants of sodium and chloride ions in solution, sodium ions in excess also cause a breakdown of soil structure, especially where there is a high clay content. This change may inhibit the growth of plants that are sensitive to high alkalinity and impeded drainage. The soil structure is not likely to recover (or at least only very slowly) without cultivation and remedial treatment, which it will not receive on roadsides.

The distribution on verges of salt residues from road salting operations follows the same pattern as that of lead, with high concentrations next to the carriageway and an exponential decrease with increasing distance from it. Effects of salt spray on plants, on the other hand, may be more widespread, especially as it is known that heavy vehicles moving at speed through slush and water can send up a toxic spray spreading 9 m (30 ft) or more from the carriageway. This spray is likely to produce effects on the foliage of plants, and is especially damaging to planted woody species. Nevertheless, observed damage to vegetation, both as a result of soil effects and from direct exposure to spray, is most apparent close to the carriageway, so that very often in winter bare patches develop by the hard shoulder. Several Agent Authorities reported that vegetation on motorway verges appeared to recover in the summer from winter salt damage, although analysis of the vegetation shows that the species most commonly found (Ranwell, op cit) were generally confined to those tolerant to high salinity.

As already noted above, the hard shoulders on motorways constitute a buffer zone between the carriageways and the verges, whilst the drains associated with the edge of the carriageway catch a high proportion of salt laden surface water. Theoretically, therefore, motorway verges and banks should be less liable to salt deposits and damage than roads without these features. The lack of disturbance of the motorway verges (where there is no vehicle parking or public access) should also contribute to the recovery of vegetation from pollution damage. Detailed research, contracted by the Department of the Environment's Road Research Laboratory, is in progress at Imperial College, London (Thompson, pers. comm.) into the causes of plant failures on central reserves with particular reference to salt pollution. This work specifically includes a study of salt tolerant species, and varieties of plants suitable for establishing in these and other roadside situations (see also Chapter 9). Central reserves are particularly liable to salt accumulations. They receive salt spray from both carriageways and are not protected by buffer zones. Considering the potential pollution it is sometimes surprising how well vegetation does survive.

Excess concentrations of salt can accumulate as a result of snow ploughing, and the banking of snow that has been heavily treated; and also from salt stockpiles, although where the material is stored in the properly constructed maintenance and works depots, retaining walls and drains have been made to prevent damage to the surrounding areas.

Oil and Toxic Spills. National statistics of accidental spillages of oil and petrol on motorways, and of other liquids carried in bulk, have not been seen. The methods of dealing with spillages vary greatly from one Authority to another. The greatest concern from the point of view of wildlife conservation lies in the possible hazards of pollution of water courses. These hazards clearly depend upon the location of the spill and the nature of the material spilt, but are also affected by the type of action taken to neutralise and dispose of the offending material. In general, incidents involving toxic spills are dealt with by Fire Brigades, and a variety of appropriate chemicals for emulsifying or neutralising, or of absorbent materials for 'mopping-up', may be held by them or by the motorway works units and maintenance depots. Expert advice may also be available from data books held by the Police, Fire Brigade or the County Council, or from the consigners, carriers, or from chemical firms. There is no statutory obligation on the emergency services to inform the Water Authority of a spillage or to consult with it on remedial action to be taken to prevent toxic materials entering water courses. In practice, Water Authorities are usually alerted by the Police, and some have prepared (or are preparing) standard procedures for dealing with the problems involved, recognising that very rapid action may be necessary. As a further step towards anticipating trouble, the Yorkshire Water Authority (and possibly others), has prepared hazard maps identifying places where spills of toxic materials might be especially dangerous.

In addition to the exceptional hazards produced by spilling substantial quantities of toxic materials, there are actual or potential pollution problems associated with the continuous deposition of oil, both generally from exhausts and leaks on vehicles, and from minor spillages at fuel stations. Oil traps have been installed at a number of service areas and maintenance depots, and more recently at one or two places in the open countryside where a motorway runs by an exceptionally sensitive watercourse, reservoir or wet area. In general, water from the carriageways, with pollutants, is carried away in drains. Where there are French and rubble drains, much of the suspended matter is likely to be filtered out before the water is discharged, but with piped or channel drains this is less likely. There is very little information about the pollutant load of water drained from road surfaces, although research contracted by the Transport and Road Research Laboratory is in progress in the Public Health Engineering Section at Imperial College, London, using sampling sites mainly on the M4 (Perry, pers. comm.). Otherwise the only report seen by the author concerns a study on the A38(M) Aston Expressway (Hedley & Lockley, n.d.), showing that drainage from an 800 m length of this very busy road carried a pollutant load that was significantly higher in winter than summer. Winter salting contributed directly to this result, and was thought also to have indirect effects connected with the initiation of corrosion of vehicle parts and of street furniture. Thus in addition to exhaust pollutants, wear and corrosion of vehicles contributed significantly to the metallic pollution load; oil was not detected in the free state but it may have combined with rubber and bitumen particles, particularly in the black gelatinous sludge found in the drainage sedimentation chambers. It is evident from these observations that much of the particulate matter deposited on roads is normally intercepted (but not under storm conditions) in catch pits, sedimentation chambers, gulleys and other apparatus which are regularly scavenged. In stormy weather, however, significant quantities of particulate matter can be discharged into water-courses outside the motorway boundary. Dissolved materials will pass out under all conditions.

In this connection it is worth noting that not all drains take water from the motorways: a substantial proportion at the tops and bottoms of cutting slopes prevent water getting on to them. Water in these ditches and drains is unlikely to be affected by pollutants from the carriageways, although it may be by atmospheric pollution, or by leachates from neighbouring (agricultural) land.

CONCLUSION

There are a number of hazards to wildlife arising from the various sources of pollution. Plants are affected by salt and to some extent by other matter deposited on their leaves. Lead residues above the statutory limit make the otherwise useful harvesting of grass for animal feed unacceptable (even if it were possible for other administrative reasons), thus preventing a form of management that would be advantageous for the development of herb rich swards. There is no evidence that either salt or lead contamination of plants and soil are having an effect on animals (ground insects, small mammals, birds in particular), but the hazard exists. Litter is potentially dangerous for animals, although some organic litter provides food. There are again potential risks to wildlife from oil and toxic spills, and largely unknown risks associated with the discharge of polluted drainage from the motorways into water courses outside the motorway boundary. In intensively trafficked areas, some of these hazards may be having an effect on diversity and populations of wildlife, but at the present time in rural areas the dangers appear to be very low. It is concluded that the advantages of motorway areas for wildlife conservation considerably exceed any pollution risks that have so far been identified.

CHAPTER 11

COSTS OF GRASS MANAGEMENT IN 1974

Agent Authorities were asked to detail total costs for motorway grass management during either the 1973 or 1974 season; ascribe them as a proportion of total routine motorway maintenance (excluding winter maintenance - salting, gritting etc.); list unit costs for mowing and spraying, and provide any details of other relevant management charges.

19 of the 29 Authorities gave full information, although not always in the same form; sometimes including costs of management of the central reservation and sometimes not. Of these 19, four gave costs for 1973 and one an estimate for 1975, otherwise all costs were for 1974. The remaining Authorities either did not have the figures to hand, or were unable to disentangle figures for grass management from those for other maintenance operations (sweeping, gully cleansing), booked under the same cost heading.

Costs of grass mowing and spraying in 1974 (including the four figures for 1973 and the estimate for 1975) are estimated at £159,000 for the 957 km (598 miles) of motorway represented by the 19 Authorities (Appendix Table 11.1). This gives a total of £292,000 for the entire motorway system, at a crude average cost of £165 per km (£265 per mile). Nine of the nineteen Authorities, representing 265 miles (or 44% of the 598 miles), incurred costs of less than £125 per km (£200 per mile) of motorway.

Grass management costs on motorways as a percentage of general maintenance expenditure varied from 1.7% to a high of 32.3%, averaging 9.2%, about twice the proportion obtained in 1972 when investigating the costs of all maintenance of County roads (Way, 1973).

Mowing costs depend on the contours and steepness of the ground, obstructions and access; the density of the vegetation, and the working width of the cutting machine. Side arm flail machines have cutting heads varying in width from one metre (3 ft 3 ins) to 1.8 m (6 ft), of which the most commonly used are in the region of about 1.2 m (4 ft). Rear mounted machines may have cutting heads up to 2.1 m (7 ft) but widths of 1.5 m to 1.8 m (5 ft to 6 ft) are probably more common. There are also side mounted flail machines (i.e. operating directly from the tractor and not having a 'reaching' capability) that have heads up to 1.8 m (6 ft). Rear mounted machines are generally able to travel faster because they are simpler to operate than side-arm machines, and the width of cut is usually greater. Thus in ref. 6, Appendix Table 11.1, a rear mounted machine is shown to cut an acre in about 40 minutes (a hectare in c. 100 minutes), whereas a side arm machine takes about twice as long. General experience appears to be that mowing half an hectare (or one acre) of grass may take from one and a half to four hours, and that on average only one to one and a quarter hectares, or two to two and a half acres, may be cut in a day. Costs consequently vary from £1.34 to £10.62 averaging c. £5.75 per acre, or c. £14 per hectare; this compares with £4.28 per acre, or c. £10.60 per hectare, for County road verge mowing in 1972 (Way, 1973).

Costs of applying sprays (MH + 2,4-D, or MH alone) varied between £10 and £19 an acre, averaging £13.60 (£33.58 per hectare) compared with £11.31 (£27.93 per hectare) for County road verge applications in 1972.

The comparative costs of fence and hedge maintenance have been discussed in Chapter 8.

SUMMARY AND CONCLUSIONS

The report contains an analysis of information provided by the Department of the Environment, and 29 County Councils, concerning the extent, function and management of grassed and planted areas by motorways in England and Wales up to January 1975. The report is written from the standpoint that these areas are already, or are potentially, valuable as additional new wildlife habitats in the countryside.

1. The acreage of land associated with the carriageways of motorways in England and Wales (1974) is estimated at 5600 ha (14,000 acs) for 1763 km (1102 miles). This represents an average of 3.2 ha/km (12.6 acs/mile) but it is noted that in hilly country, where there are large cuttings and embankments, the acreage is greater than in flat country. Tables are given showing the ages of individual sections of motorway, and of the Agent Authorities (County Councils) responsible for maintenance.

2. A short account is given of the geological formations through which the motorways pass, together with the relationship between geology and landscaping of the motorway corridor. An analysis has been made of adjacent land uses, which indicates crudely that one third of the land is arable, one third of improved grassland, and one third of other land uses (woodland, urban/industrial, derelict, and unimproved grassland). Approximately 80% of the adjoining land immediately outside the motorway boundary is of low wildlife interest, and 20% (woodlands, etc.) of potential wildlife value.

3. Procedures for the ab initio establishment of grass are described, together with the various attempts that have been made to diversify the vegetation through planting and sowing of wild species. The medium to long-term (25-100 years) nature of natural colonisation is emphasised. The parallel between the biological interest of railways and the potential for motorways is briefly discussed.

4. Planting of c. 10 million trees and shrubs for landscaping by the Department of the Environment between 1963 and 1974 is reported. Management of the planted areas is generally in the hands of the Forestry Commission as Agents for the DOE.

5. Reasons for management of the grassed areas are analysed. It is concluded that for the greatest proportion of the land there are no highway engineering requirements beyond ensuring the stability of banks and effective drainage. Amenity, agricultural and wildlife conservation considerations are discussed. It is concluded that in the absence of other priorities, the management of motorway land for wildlife conservation is of value in the national interest.

6. Theoretical factors of the effects of motorways on wild animals indicate that only for badgers (Meles meles) is there a serious hazard to breeding populations. For insects, small mammals and probably many other groups, motorways have provided important additional habitats, especially in the 80% of the country through which they pass (see para. 2 above) of assumed low wildlife interest.

7. Actual programmes of grass management by County Councils in 1974 are reported. It is argued that the effects of the policy of not mowing grassed areas, introduced by the DOE in July 1975, will not be in the interests of the conservation of diversified and herb rich grassland habitats. These habitats are considered to be the most valuable contribution that motorway areas can make to wildlife conservation, although the contribution of other habitats will always be of interest.

8. The provision of ditches, drains, fences and hedges is discussed, together with some of their management requirements. A comparative analysis of the economics of fences and hedges in the medium-term is presented. On the assumptions and figures used it is shown that over a 60 year period, hedges to replace fences would introduce savings in costs equivalent to c. 60% of the annual cost of grass management (see para. 11, below).

9. Factors connected with the central reservations are discussed. It is concluded that there is no wildlife interest of any importance in these areas.

10. A short account is given of traffic generated pollution of the motorway environment. Lead residue levels in soils and vegetation are known to be high; their significance for wildlife is unknown, but thought to be small. The principle potential hazard appears to be from polluted drainage water, and especially from unpredictable spillages of toxic loads contaminating watercourses outside the motorway boundary.

11. Costs of grass management in 1974 were calculated from figures given by Agent Authorities at c. £300,000 for motorways in England and Wales. This averages c. £165/km (£265/mile) of motorway, representing about 9.2% of general (e.g. excluding winter salting and gritting) maintenance. Assuming that some grass management by the hard shoulder, at sight lines and other critical areas, will continue to be done, the net saving from not cutting motorway grass (see para. 7 above) will not be the whole of this amount.

ACKNOWLEDGEMENTS

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APPENDIX FIGURES

Figure 1 General distribution of motorways in England and Wales, 1974.

Figure 2 The M1, M10, M18, M45, M606 and M621. Southern and midland parts of the A1(M).

Figure 3 The M2, M20, M23, M3, M32, M4 and M40. A308(M), A329(M) and A423(M).

Figure 4 The M5 and M50 motorways.

Figure 5 The M53, M56, M57, M6, M61, M62, M63, M66, M602, M606 and M621. A38(M), A627(M), and northern parts of the A1(M) with A66(M) and A194(M).

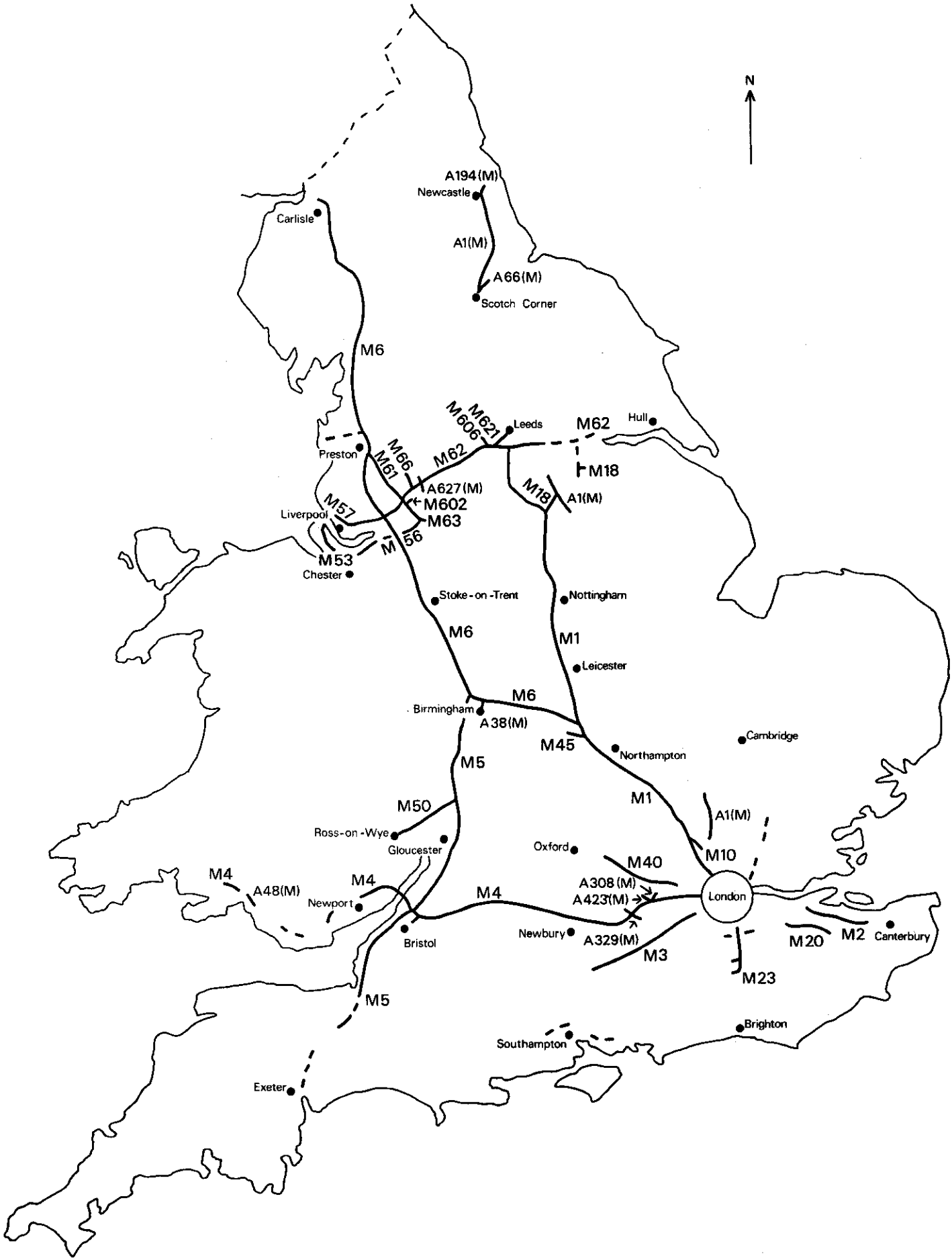

Fig. 1
General distribution
of motorways

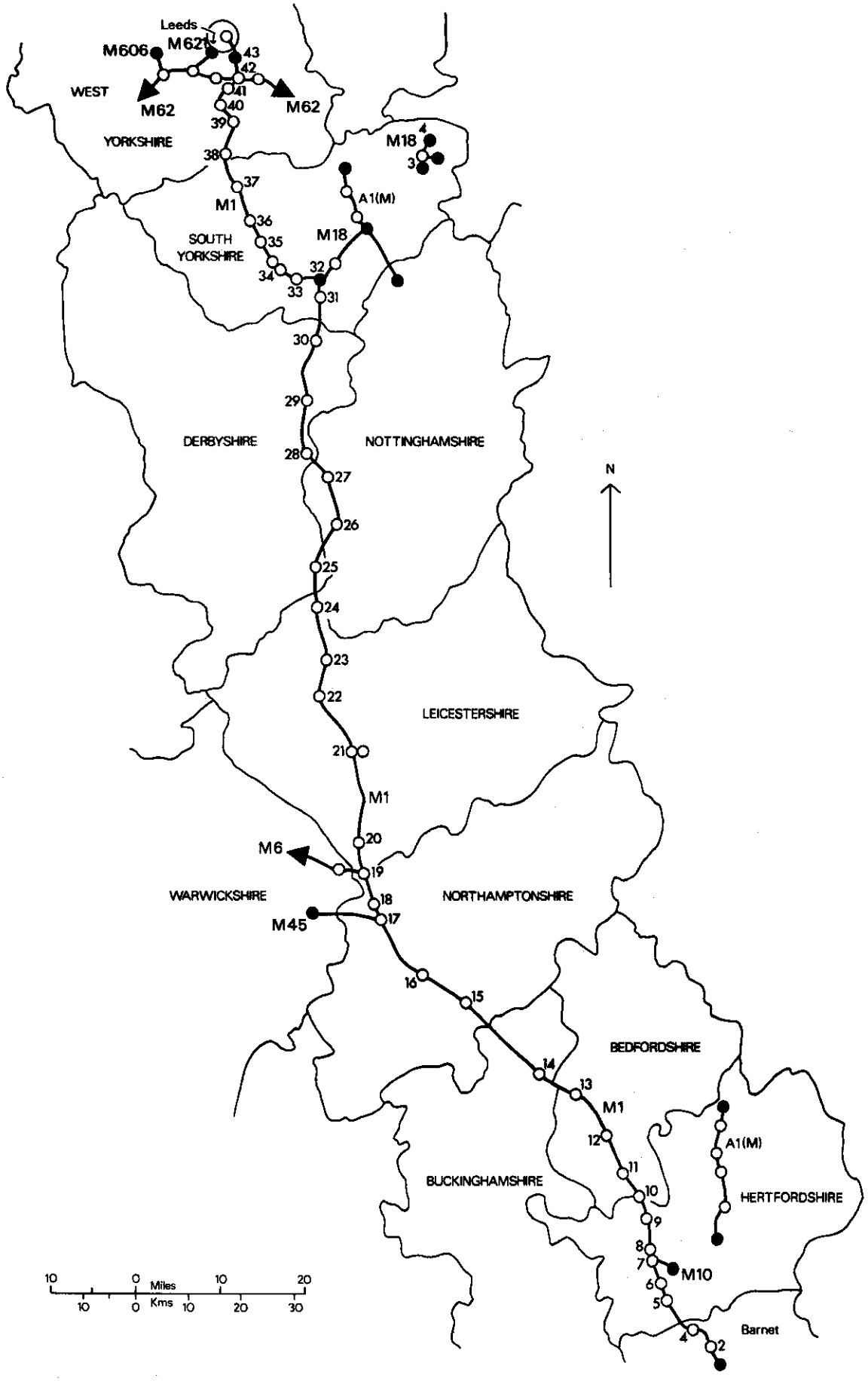

Fig. 2
M1, M10, M45, A1(M)

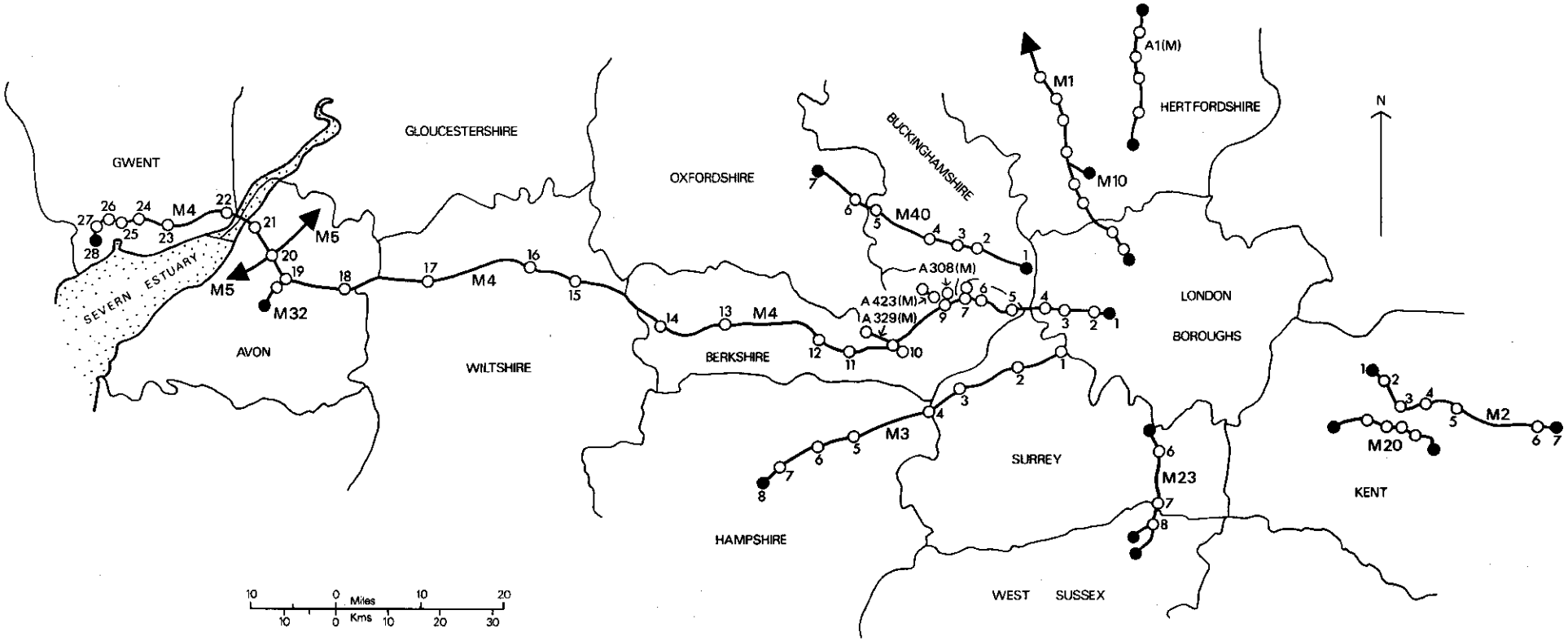

Fig. 3
M2, M20, M3, M4, M40

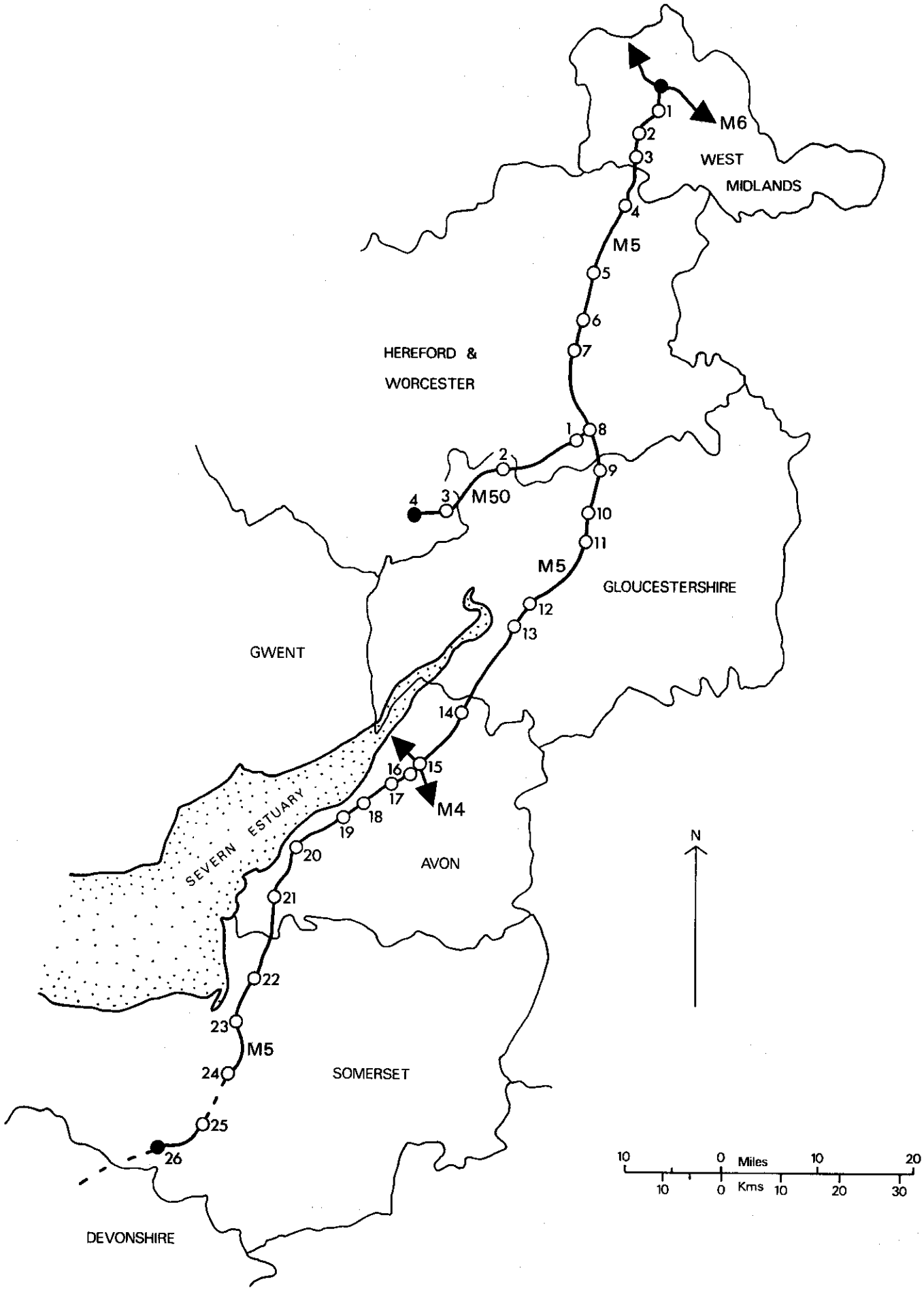
M6
WEST
MIDLANDS
M5
HEREFORD &
WORCESTER
M50
M5
GLOUCESTERSHIRE
GWENT
M4
SEVERN ESTUARY
AVON
M5
SOMERSET
DEVONSHIRE
N
10 0 Miles 10 20
10 0 Kms 10 20 30

Fig. 4
M5

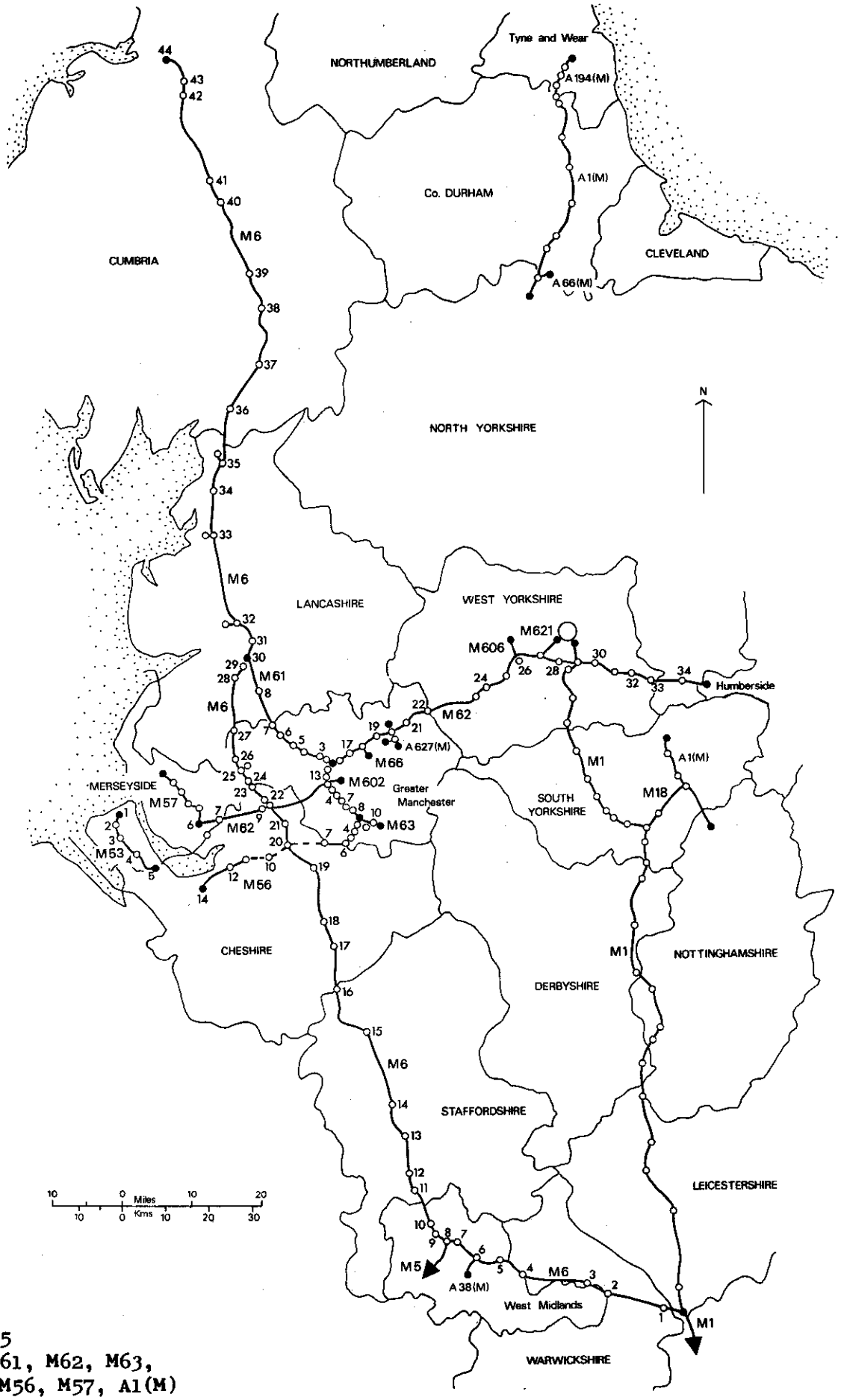

Fig. 5
M6, M61, M62, M63,
M53, M56, M57, A1(M)

APPENDIX TABLES

Table 2.1 Details of Motorway sections in England and Wales open to traffic up to December 1974, including Maintaining Agent Authorities (County Councils as at April 1975). J = Junction

M1 LONDON - YORKSHIRE MOTORWAY, including M10, M45 and Enderby Spur

SECTION From	To	Junction/Marker post From	To	Mileage	Date opened to traffic	Agent Authority
Fiveways Corner Flyover				0.5	July 1970)	
Fiveways Corner	Brockley Hill	J2	J4	4.3	May 1967)	London Borough of Barnet
Brockley Hill	Aldenham	J4	J5	4.0	Oct 1966)	
Aldenham		J5	J10	13	Nov 1959	Hertfordshire CC
		J10	J13	16	Nov 1959	Bedfordshire CC
		J13	Km94	13	Nov 1959	Buckinghamshire CC
	Crick	Km94	J18	20	Nov 1959	Northamptonshire CC
Crick	Markfield	J18	J22	26	Oct 1964 - Jan 1965)	Leicestershire CC
Markfield	Kegworth	J22	J24	11	Dec 1965)	
Kegworth	Nuthall	J24	J26	11	May/Aug 1966	Derbyshire CC
Nuthall	Pinxton	J26	J28	8.5	May/July 1967	Nottinghamshire CC
Pinxton	Barlborough	J28	J30	13.9	Oct 1967	Derbyshire CC
Barlborough		J30	J34	13.7	Dec 1967)	South Yorkshire CC
	Haigh	J34	J38	14.5	June-Oct 1968)	(previously W. Riding)
Haigh	East Ardsley	J38	J42	9.1	Aug-Oct 1968)	West Yorkshire CC
East Ardsley	Stourton	J42	J43	4.5	Oct 1967)	(previously W. Riding)
Stourton	Leeds Extension (Local Authority Motorway)			2.5	1972)	
	Total mileage			185.5		
M10 Spur (Hatfield)		J10	A405	4	Nov 1959	Hertfordshire CC
M45 Spur (Coventry)		J17	A45	8	Nov 1959	Northamptonshire CC
Enderby Spur (Leicester)		J21	J21A	1	Oct 1964	Leicestershire CC
M18 ROTHERHAM - GOOLE MOTORWAY						
Morthen	Doncaster By-Pass	M6 interchange	A1(M) interchange	9.5	Dec 1967))	South Yorkshire CC (previously W. Riding)
Hatfield	Thorne			3.5	June 1972)	
	Total mileage			13.0		

SECTION From	To	Junction/Marker Post From	To	Mileage	Date opened to traffic	Agent Authority
M2 MEDWAY MOTORWAY						
		J1	J7	25.2	May-Sept 1963	Kent CC
M20 MID KENT MOTORWAY						
Maidstone By-Pass				6.8	Dec 1960)	Kent CC
Ditton By-Pass				6.8	Dec 1971)	
	Total mileage			13.6		
M3 LONDON - BASINGSTOKE MOTORWAY						
Sunbury Cross	Lightwater	J1	J3	13.0	1974)	Surrey CC
Lightwater	Hawley	J3	J4	5.7	June 1971)	
Hawley	Popham	J4	(J8)	22.3	May-June 1971	Hampshire CC
	Total mileage			41.0		

Table 2.1 p.2

SECTION From	To	Junction/Marker Post From	To	Mileage	Date opened to traffic	Agent Authority
M4 LONDON - SOUTH WALES MOTORWAY (including A308(M), A423(M), A329(M), M32)						
Chiswick	Langley	J1	J5	12.5	Nov 1964 - Mar 1965	London Borough of Hounslow
Slough By-Pass		J5	J7	5.4	April 1963)	Berkshire CC
Maidenhead By-Pass		J7	J9	5.9	June 1961)	(widened Oct 1971)
Holyport	Badbury	J9	J15	49.2	Dec 1971	Berkshire CC
Badbury	Tormarton	J15	J18	28.6	Oct-Dec 1971	Wiltshire CC
Tormarton	Severn Bridge and approaches	J18	J22	19.9	Sept-Dec 1966	Avon CC (from Gloucestershire CC 1974)
Severn Bridge	-	J22	J24	12	1967)	Gwent CC
		J24	J28	7	1968)	
	Total mileage M4			140.5		
A308(M) M4 to A308 (Reading-Windsor)				0.5	1972	Berkshire CC
A423(M) M4 to Maidenhead Thicket (J9B)				2.5	1961 (widened 1971)	Berkshire CC
A329(M) Reading to Wokingham Link (Local Authority Motorway)				7.5	Jan 1973 - Mar 1974	Berkshire CC
M32 Bristol Parkway (Local Authority Motorway)				4	1967-1970	Avon CC (from Gloucestershire CC 1974)
M40 LONDON - OXFORD MOTORWAY						
Denham	Knaves Beech	J1	J2	7	1974)	
Knaves Beech Interchange		J2		0.8	May 1972)	
Beaconsfield By-Pass		J2	J3	1.3	Mar 1971)	Buckinghamshire CC
Burkes Road	Handy Cross	J3	J4	4.8	Mar 1969)	
Handy Cross	Stokenchurch	J4	J5	8.0	June 1967)	
Stokenchurch	-	J5	J7	9.5	1974	Handing over from contractors to Oxfordshire CC 1975
	Total mileage			31.4		

Table 2.1 p.3

SECTION From	To	Junction/Marker Post From	To	Mileage	Date opened to Traffic	Agent Authority
M5 BIRMINGHAM - BRISTOL - EXETER MOTORWAY						
Ray Hall	Quinton	M6 interchange	J3	10.5	May 1970	West Midlands CC (M6-J2 from Staffordshire CC, J2-J3 from Hereford & Worcester CC Apl 1975)
Quinton	Lydiate Ash	J3	J4	6.0	Nov 1965)	Hereford & Worcester CC
Lydiate Ash	Strensham	J4	<J9	26.0	July 1962)	(previously Worcestershire CC)
Strensham	Bredon		±J9	1.2	June 1970)	
Bredon	Piffs Elm	>J9	J10	7.1	June 1970)	
Piffs Elm	North of Eastington	J10	J13	15.0	April 1971)	Gloucestershire CC
North of Eastington	Falfield	J13	J14	10.5	Dec 1971)	
Falfield	North of Almondsbury	J14	<J15	8.3	Dec 1971)	Avon CC (J14-J18 from Gloucester-
Almondsbury interchange		J15/16		1.3	Sept 1966)	shire and J19-J21 from
Filton By-Pass	)	J16		2.3	May 1963)	Somerset in 1974)
Cribbs Causeway	Avonmouth)		J18	4.3	Aug 1969)	
Avonmouth Bridge		J18	J19	2.0	1974)	
Avonmouth Bridge	St Georges	J19	J21	13.8	Jan 1973)	
St Georges	Edithmead	J21	J22	8.8	Jan 1973)	
Edithmead	Dunball	J22	J23	5.9	July 1973)	
Dunball	Huntworth	J23	J24	5.0	1973)	Somerset CC
		missing			)	
Blackbrook	Chelston	J25	J26	7.3	1974)	
	Total mileage			135.3		
M50 ROSS SPUR MOTORWAY						
M5	Ross-on-Wye	M5 interchange	J4	21.5	Nov 1960	Hereford & Worcester CC Previously divided at J2 between Herefordshire & Worcestershire

Table 2.1 p.4

SECTION From	To	Junction/Marker Post From	To	Mileage	Date opened to traffic	Agent Authority
M53 MID WIRRAL MOTORWAY						
Bidston Moss interchange	Hooton	J1	J5	11.4	Feb-May 1972	Merseyside CC (from Cheshire 1975)
M56 NORTH CHESHIRE MOTORWAY						
Gatley	Wythenshawe	M63 interchange	J4	2.0	1974)	Greater Manchester CC (from Cheshire CC 1975)
Wythenshawe	Davenport Green	J4	J5	3.0	Jan 1972)	
Davenport Green	Bowdon	J5	J7	4.0	Jan 1972)	Cheshire CC
Preston Brook	Hapsford	J11	J14	8.0	Feb-Sept 1971)	
	Total mileage			17.0		
M57 LIVERPOOL OUTER RING ROAD						
Local Authority Motorway				9.8	1972-1974	Merseyside CC (from Lancashire CC 1975)

Table 2.1 p.5

SECTION From	To	Junction/Marker Post From	To	Mileage	Date opened to traffic	Agent Authority
M6 CATTHORPE - BIRMINGHAM - PRESTON - CARLISLE MOTORWAY. A38(M) ASTON EXPRESSWAY						
Catthorpe	A426	M1 interchange	J1	4	Nov 1971	Leicestershire CC
A426	Coleshill	J1	J4	19.8	July 1971	Warwickshire CC
Coleshill	Castle Bromwich	J4	J5	4.9	Feb 1971)	West Midland CC (transferred from Warwickshire CC 1975)
Castle Bromwich	Queslett Road	J5	J7	6.8	May 1972)	
Queslett Road	East of Ray Hall	J7	J8	0.8	May 1972)	West Midland CC (transferred from Staffordshire CC 1975)
East of Ray Hall	Bescot	J8	J9	3.6	May-July 1970)	
Bescot	Darlaston	J9	J10	0.6	Dec 1968)	
Darlaston	Dunston	J10	J13	14.3	Mar-Sept 1966)	Staffordshire CC
Dunston	Barthomley	J13	J16	25.5	Aug-Nov 1962)	
Barthomley	North Ashton	J16	J25	36	Nov 1962	Cheshire CC (J21-J25 (10 miles) transferred from Lancashire 1974)
North Ashton	Preston	J25	J29	17	Nov 1962)	
Preston By-Pass		J29	J32	8.1	Dec 1958)	
Preston	Lancaster	J32	J33	13.3	Jan 1965)	Lancashire CC
Lancaster By-Pass		J33	J35	11.4	April 1960)	
Carnforth	Burton Services	J35	J35/36	4	Oct 1970)	
Burton Services	Thrimby	J35/36	J39/40	30.6	Oct 1970)	
Thrimby	Hackthorpe	J39/40		2.3	Aug 1969)	
Penrith By-Pass		J39/40	J41	7.9	Nov 1968)	Cumbria CC (previously Westmorland CC and Cumberland CC)
Penrith	Carlisle	J41	J42	12.3	July 1971)	
Carlisle By-Pass		J42	J44	7.0	Dec 1970)	
	Total mileage			230.2		
M6 - Birmingham. Aston Expressway Local Authority Motorway				2.3	1972	West Midlands CC
M61 MANCHESTER - PRESTON MOTORWAY						
A580	Horwich	J1/M62 interchange	J6	9.2	Dec 1970	Greater Manchester CC (from Lancashire CC 1975)
Horwich	Preston	J6	J9/M6 interchange	13.1	Nov 1969	Lancashire CC
	Total mileage			22.3		

SECTION From	To	Junction/Marker Post From	To	Mileage	Date opened to traffic	Agent Authority
M62 LANCASHIRE - YORKSHIRE MOTORWAY, including M66, M602, A627(M), M606, M621, A58(M), A57(M)						
A49	Holcroft Lane	J9		6	1974	Cheshire (from Lancashire 1974)
Holcroft Lane	Worsley		J12	5	1974)	Greater Manchester Council
Worsley	Whitefield	J12	J17	6.1	Oct 1970)	(transferred from Lancashire
Whitefield	Moss Moor	J17	J22	13	Aug 1971)	1975)
Moss Moor	Outlane	J22	J23	7.8	Dec 1970)	
Outlane	Ainley Top	J23	J24	1.0	Dec 1972)	
Ainley Top	Chain Bar Interchange	J24	J26	7.5	July 1972)	West Yorkshire (previously West
Chain Bar Interchange	Gildersome	J26	J27	3.8	Oct 1973)	Riding of Yorkshire)
Gildersome	Lofthouse	J27	J29	5.8	Dec 1970)	
Lofthouse	Whitley Bridge A19	J29	J34	14.1	1974)	
	Total mileage			70.1		
M66 Middleton Link, Middleton - Bury (1.2 miles south of M62 interchange, built as Local Authority Motorway)				4.3	1971/74	Greater Manchester CC (from Lancashire 1975)
M602 Eccles By-Pass M62 - Eccles Centre				1.8	1971)	Local Authority Motorways,
A627(M) Rochdale - M62 - Slattocks Link and Broadway extension				5.9	1972)	Greater Manchester CC (from
A57(M) Mancunian Way, Manchester City Centre				1.4	1972)	Lancashire 1975)
M606 Bradford South Radial Motorway				2.4	1972)	West Yorkshire (previously West
M621 Gildersome - Leeds Motorway				2	1972)	Riding of Yorkshire)
A58(M) Leeds Inner Ring road				1.9	1972)	Local Authority Motorways
M63 STRETFORD - ECCLES BY-PASS AND SOUTHEASTERN EXTENSION TO STOCKPORT						
Stretford	Eccles By-Pass	J1/M62 interchange	J6/A56 interchange	6.0	1960	Greater Manchester CC (from Lancashire CC 1975). Built as Local Authority Motorway, about to be trunked (1975)
Southeast extension J6/A56	intercharge	M56/A34 interchange		5.6	1974	Greater Manchester CC (from Cheshire CC 1975). Built as trunk road motorway
	Total mileage			11.6		

SECTION From	To	Mileage	Date opened to traffic	Agent Authority
A1(M) and A66(M)				
Hatfield to	Stevenage By-Pass	4.0	1974)	
Stevenage By-Pass		7.1	July 1962)	Hertfordshire CC
Baldock By-Pass		6.6	June-Aug 1967)	
Doncaster By-Pass		15.5	July 1961	South Yorkshire CC (previously West Riding of Yorkshire CC)
	Total mileage	33.2		
A1(M), DURHAM MOTORWAY and A194(M)				
Darlington By-Pass				
B6275 junction to A68 junction and A66(M) Spur		7.5	May 1965	North Yorkshire CC (previously North Riding of Yorkshire CC)
A68 junction to Aycliffe		5.5	May 1965	Co. Durham CC
Aycliffe	Bradbury	5.5	Oct 1967)	
Bradbury	Birtley By-Pass	16.8	Jan-Sept 1969)	Co. Durham CC
Birtley By-Pass		2.5	Mar 1970)	
A194(M) Blackfell - White Mare Pool		3.7	1970	Tyne & Wear CC (from Co. Durham CC 1975) Local Authority Motorway
	Total mileage	41.5		

Table 2.2 Mileages at December 1974 of Motorway maintained by individual Agent Authorities (County Councils as from 1 April 1975). With notes on grassed and planted areas.

COUNTY	MOTORWAY	From	To	Mileage	Notes
AVON	M4	J18	J22	18.5	Transferred from Gloucestershire April 1974. Considerable acreage of land at the Almondsbury interchange and Severn Bridge approaches, also at the Avon Bridge interchange.
51 miles	M5	J14	J22	28.5	Transferred from Gloucestershire J14-18 and Somerset J19-21, April 1974.
	M32	M4 interchange	J2	4	Bristol Parkway Local Authority Motorway.
BEDFORDSHIRE	M1	J10	J13	16	100 acs maintained, 100 acs in addition (total 12.5 acs/mile). Further small off-cuts, outside the motorway boundary; usually bad access and generally not managed.
BERKSHIRE	M4	J5	J15	59	Winersh interchange covers 46 acs.
	A423(M)	M4 interchange -	Maidenhead Thicket	2.5	
70 miles	A308(M)	M4 interchange -	A308	0.5	
	A329(M)	Reading - M4 interchange - Wokingham By-Pass		8.0	Local Authority Motorway.
BUCKINGHAMSHIRE	M1	J13	94Km post	13	About 70 acs managed and 70 acs unmanaged (total 10.76 acs/mile). Additionally about 18 acs in six parcels outside the motorway boundary. All planted and managed by the Forestry Commission.
37 miles	M40	J1	J5	24	

COUNTY	MOTORWAY	From	To	Mileage	Notes
CHESHIRE	M6	J16	J25	37	J21-J25 transferred from Lancashire April 1974.
	M56	J5	J7	4	M63 interchange to J5 where complete transferred to Greater Manchester April 1975. J7-J11, including M6 interchange, under construction 1974/75.
		J11	J14	8	
55 miles					
	M53	J2	end		Transferred to Merseyside April 1975.
	M62	J9 (A49 interchange) to Holcroft Lane		6	Completed 1974.
	M63	A56 interchange southeast		-	Transferred to Greater Manchester April 1975. Opened to traffic 1974, managed by Cheshire during maintenance period.
CUMBRIA	M6	Burton Services J35/36 - J44		62	276 acs of grass (156 acs managed), 156 acs of plantations (total 7 acs/mile). About 20 acs outside motorway boundary, some planted by Forestry Commission and maintained by them, others managed by County Council to control weeds. Separated area totalling about 100 acs between carriageways for about 3 miles north of Tebay. Handed back to agriculture for sheep grazing. Sheep creeps under the carriageways to give access. Other separated areas not large enough or not suitable and no access provided.
DERBYSHIRE	M1	J24	J26	11	321 acs grass managed, 244 acs unmanaged including plantations, (total 22.6 acs/mile) plus 36 acs of Central reserve and 13 acs of managed grass at intersections. Additional areas outside the motorway boundary including 20-30 acs reserved for a future service area. J26-J28 lies in Nottinghamshire.
		J28	J30	14	
25 miles					
DEVONSHIRE	M5	Exeter	J27		Cullompton By-Pass open, other stretches under construction.

COUNTY	MOTORWAY	From	To	Mileage	Notes
CO DURHAM	A1(M)	Interchange with A68 - junction with A194(M)		27	About 60 acs of land outside the Motorway boundary, 10-12 acs managed, remainder planted or unmanaged.
32 miles	A194(M)	A1(M)	A184 (White Mare Pool)	5	Local Authority Motorway. (?) Transferred to Tyne and Wear CC.
GLOUCESTERSHIRE	M5	J5	J14	31	390 acs (total 12.6 acs/mile). Additional 5-10 acs outside Motorway boundary, all grass. J14-J18 to Avon in April 1974.
	M4			-	J18-J22 to Avon in April 1974.
GREATER MANCHESTER	M56	M63 interchange	J5	5.0	From Cheshire April 1975.
	M61	M6 interchange J1	- J6	8.75	From Lancashire April 1975.
	M62	Holcroft Lane	J22	22	Holcroft Lane - J12 opened 1974; J12-J22 from Lancashire April 1975.
	M63	M62 interchange to A56 interchange	)	6	(Built as Local Authority Motorway. To be (trunked. From Lancashire April 1975.
67.8 miles		A56 interchange - Stockport	)	10.5	(Recently completed as Trunk Road Motorway. (From Cheshire April 1975.
	M66	Bury - M62 interchange	)	1.2	(Motorway) From Lancashire
		M62 interchange - Middleton	)	4.25	(Local Authority Motorway) April 1975
	M602	Eccles By-Pass		1.75	)
	A627(M)	Oldham - Rochdale		5.9	)Local Authority Motorways.
	A57(M)	City Centre		1.25	)From Lancashire April 1975.
	-	Airport Link from M56		1.25	)

COUNTY	MOTORWAY	From	To	Mileage	Notes
HAMPSHIRE	M3	J4 to slip road 3 miles west of J7		24	Some small cut-offs, mainly in low lying damp areas.
HEREFORD AND WORCESTER	M5	J3	J9	35	J2-J3 to West Midlands, April 1975.
	M50	M5 interchange -	J4	21.5	Formerly divided between Herefordshire and Worcestershire.
56.5 miles				M5 and M50	(For the 58 miles of Motorway before April 1975, (50 acs of banks were mown, 70 acs planted and (340 acs unmanaged (460 acs) (total 8.6 acs/mile), (Also 90 acs of central reserve. In addition, (there were 39 acs at interchanges etc, 12 (planted, 27 in grass. Outside the Motorway (boundary there were up to 18 acs of off-cuts, (mainly in the south of the County. Some of (these areas were planted and looked after by the (Forestry Commission. The M5 is the smallest (cross-section Motorway in the UK, largely due to (economies on the land taken at the time of con- (struction.
HERTFORDSHIRE	M1	J5	J10	13	70 acs of grass maintained.
34.7 miles	M10	All		4	
	A1(M)	Hatfield	Baldock By-Pass	17.7	
HUMBERSIDE	M18	under construction			
	M62	J35			A short length of M62, including J35, was opened in Humberside in late 1974.
KENT	M2	All		27	
43 miles	M20	All		16	55 acs maintained, 163 acs planted (total 13.6 acs/mile).

COUNTY	MOTORWAY	From	To	Mileage	Notes
LANCASHIRE	M6	J25	Burton Services J35/J36	57	J21-J25 to Cheshire, April 1974.
	M61	J6	M6 interchange	13.1	M62 interchange to J6 to Greater Manchester, April 1975.
	M62			-	Part to Cheshire April 1974 and part to Greater Manchester, April 1975.
	M63			-	To Greater Manchester, April 1975))
70.1 miles	M66			-	To Greater Manchester, April 1975)) Local
	M602			-	To Greater Manchester, April 1975)) Authority
	A627(M)			-	To Greater Manchester, April 1975)) Motorways
	M57			-	To Merseyside, April 1975)
					About 25 acs planted and maintained outside the Motorway boundary. M61/62 interchange covers 79 acs, some of which is planted. In 1974, when there were 154 miles of Motorway in the County, there were 1,700 acs of grassed and planted land (total 11.1 acs/mile).
MERSEYSIDE	M53	All		11	From Cheshire, April 1975.
23 miles	M57	All		12	From Lancashire, April 1975. Built as Local Authority Motorway.
LEICESTERSHIRE	M1	J18	J24	38	All off-cuts handed back to original owners (or assignees). About 16 acs at Lutterworth Works Unit potential future service area.
42 miles	M6	M1 interchange	J1	4	

COUNTY	MOTORWAY	From	To	Mileage	Notes
NORTHAMPTONSHIRE	M1	94km post	J18	20	
28 miles	M45	M1 interchange	J8	8	
NOTTINGHAMSHIRE	M1	J26	J28	9.5	124 acs grass, 60 acs planted (total 19.4 acs/mile).
OXFORDSHIRE	M40	J5	J7	9.5	Still in maintenance by Contractors 1974.
SOMERSET	M5	J21 J25	J24 J26	27	J24-J25 not open 1974. J19-J21 to Avon, April 1974. 10.65 acs outside the Motorway boundary.
STAFFORDSHIRE	M6	J10	J16	39.8	J7-J10 to West Midlands, April 1975.
	M5	M6 interchange	J2	- M5 and M6	To West Midlands, April 1975. In 1974, 49 miles of Motorway, 220 acs managed grass plus 343 rough grass and planted (total 11.5 acs/mile).
SURREY	M3	J1	J4	18	432 acs grassed and planted (total 24 acs/mile). In the Chobham Common area (and elsewhere) a lot of land purchased for the construction of the Motorway has subsequently been handed back after regrading, and the Motorway boundary fence brought down close to the hard shoulder.
WARWICKSHIRE	M6	J1	J4	14.75	J4-J7 to West Midlands, April 1975. Some small off-cuts, about 5 acs in all, including one of about 3 acs, managed by contract under DOE arrangements. In 1974, the length J3-J7, 21 miles, had 120 acs (total 5.8 acs/mile) of grassed and planted slopes and flats. The flats averaged 12' wide and the slopes 30' wide. 11.5 acs of this area were planted. In addition there were 9 miles of viaduct and 22 acs of grass associated with the Gravelly Hill interchange.

COUNTY	MOTORWAY	From	To	Mileage	Notes
WEST MIDLANDS	M5	M6 interchange	J3	10.25	M6 interchange - J2 from Staffordshire, J2-J3 from Hereford and Worcester, April 1975.
	M6	J4	J10	17.25	J4-J7 from Warwickshire, J7-J10 from Staffordshire, April 1975.
29.75 miles	A38(M)	M6 interchange into Birmingham		2.25	Aston Expressway. Local Authority Motorway.
WILTSHIRE	M4	J15	J18	28	136 acs managed grass, 450 acs unmanaged, 40 acs planted (total 22.4 acs/mile). 10 acs managed and 30 acs planted at interchanges etc. About 2 acs of off-cuts outside the Motorway boundary.
NORTH YORKSHIRE	A1(M)	Junction with B6275 - A68 interchange		7.5	45 acs cut)) Previously N. Riding of Yorkshire
8.5 miles	A66(M)	All to Darlington		1	10 acs cut)
	M62				Passes through N. Yorkshire but will be managed by neighbouring W. Yorkshire and by Humberside.
SOUTH YORKSHIRE	M1	J30	J38	26.5	Previously part W. Riding of Yorkshire. J30-J38 from West Riding of Yorkshire, April 1974. In 1974 estimated 300 acs of slopes, 154 acs of verge and central reserve, 38.5 acs of landscaping (total 18.6 acs/mile).
	M18	M1	A1(M)	9.5	From West Riding of Yorkshire, April 1974.
53 miles		Thorne By-Pass (isolated section)		2	
	A1(M)	Doncaster By-Pass		15	From West Riding of Yorkshire, April 1974. In 1974 estimated 102 acs of slopes, 61 acs of verge and central reserve (total 10.9 acs/mile). About 40-50 acs of off-cuts in the county outside the Motorway boundary.

Table 2.2 p.7

COUNTY	MOTORWAY	From	To	Mileage	Notes
WEST YORKSHIRE	M1	J38	J43	14	Previously part W. Riding of Yorkshire Plus 2 miles Local Authority Motorway into Leeds City J30-J38 to South Yorkshire, April 1974.
	M62	J22	J34	40	J33-J34 in N. Yorkshire but maintained by W. Yorkshire.
58 miles	M606	M62 interchange	Bradford	2	) Local Authority Motorways.
	M621	M62 interchange	Gildersome to Leeds	2	)
	M18	M1 - A1(M) Doncaster By-Pass		-	) to South Yorkshire, April 1974.
	A1(M)	Doncaster By-Pass		-	)
GWENT	M4	J22	J28	19	About 3 acs/mile managed grass.
WEST GLAMORGAN	M4	Swansea By-Pass		4	Previously Glamorganshire.
8 miles	A48(M)	Port Talbot By-Pass		4	

Table 2.3 Estimates of acreages of land associated with motorways in England and Wales, December 1974. In miles and acres with grand totals in kilometres and hectares

Motorway	Agent Authority	Mileage (from Table 2.1)	Mean acreage per mile (see text and Table 2.2)	Acreage	Total Acreage	
M1	Barnet (London Borough)	(4	5.8	23.2		Not measured. Based on Urban Motorway mean.
		(5	24.5	122.5		Measured in 1970.
	Hertfordshire	13	11.0	143.0		
	Buckinghamshire	13	11.6	150.8		
	Bedfordshire	16	12.0	192.0		
	Northamptonshire	20	11.8	236.0		
	Leicestershire	38	18.0	684.0		
	Nottinghamshire	8	20.6	164.8		
	Derbyshire	25	22.5	562.5		
	Yorkshire - West Yorkshire)	44	17.7	778.8)		
	South Yorkshire (1974))			)		Post Local Authority boundary changes.
	Total	186			3056.6	
M10 Spur	Hertfordshire	4	11.0	44.0		)
M45 Spur	Northamptonshire	8	11.8	94.4		) Based on M1 estimates
Enderby Spur	Leicestershire	1	18.0	18.0		)
	Total	13			156.4	
M18	South Yorkshire	13	10.9	141.7	141.7	Using mean for A1(M) Doncaster By-Pass
M2	Kent	) 39	13.6	530.0	530.0	7 miles of the A20(M) (Maidstone By-Pass) were
M20	Kent	)				estimated at 11.7 acs/mile in 1970 = 81.9 acres.
M3	Surrey	19	24.0	456.0		
	Hampshire	22	13.7	301.4		
	Total	41			757.4	
M4	Hounslow (London Borough)	12	5.8	69.6		Not measured. Based on Urban Motorway mean.
	Berkshire	60	13.3	798.0		
	Wiltshire	29	18.0	522.0		
	Gloucestershire	20	13.3	266.0		Avon C.C. from April 1974.
	Gwent	19	13.3	252.7		Using mean for Gloucestershire.
	Total	140			1908.3	
A308(M)	Berkshire	0.5	13.3	6.6		)
A423(M)	Berkshire	2.5	13.3	33.2		) Using Berkshire mean from M4.
A329(M)	Berkshire	7.5	13.3	99.7		)
M32	Gloucestershire	4	5.6	22.4		Avon C.C. from April 1974. Based on Urban Motor-
	Total	14			161.9	way mean.

Table 2.3 (contd.)

Motorway	Agent Authority	Mileage (from Table 2.1)	Mean acreage per mile (see text)	Acreage	Total Acreage	
M40	Buckinghamshire	22	13.6	299.0		Route through the Chilterns with many embankments and cuttings. Mean taken from M2/M20 in Kent (see text).
	Oxfordshire	10	13.6	136.0		
	Total	32			435.2	
M5 + M50	Staffordshire	5	7.4	37.0		Some urban. (Now West Midland C.C.).
	Hereford and Worcester	58	8.6	498.8		Hereford and Worcester C.C. figure includes M50.
	Gloucestershire	33	12.6	415.8		
	Avon	32	12.6	403.2		Use Gloucestershire figure.
	Somerset	27	8.6	232.2		Use Hereford & Worcester figure. Runs through a lot of flat land in the Somerset levels. But see the figure of 17.4 acs/mile obtained by Alexander (1972) for 8 miles of the M5 under construction north east of Exeter in Devon.
	Total	155			1587.0	
M53	Cheshire	11	10.6	116.6		Now Merseyside C.C.) Use Cheshire mean
M56	Cheshire	17	10.6	180.2		Now part Greater Manchester C.C.)
	Total	28			296.8	
M57	See below					
M6	Warwickshire	11	18.0	198.0		Using Leicestershire mean from the M1
	Warwickshire	23	5.8	133.4		J3-J7 and Aston Expressway A38(M)
	Staffordshire	44	11.8	519.2		Includes 5 miles since handed over to W.Midland C.C.
	Cheshire	27	10.6	286.2		37 miles less 10 acquired from Lancashire in 1974.
+ M57, M61 M66, M602, A627(M), A57(M)	Lancashire	154	11.0	1694.0		In 1974, before Local Authority Boundary changes, there were 154 miles of Motorway in Lancashire.
Part M62	Lancashire	(30)				Included in Lancashire total.
Part M63	Lancashire	(6)				Included in Lancashire total.
	Cumbria	60	7.0	420.0	3250.8	
M62	Cheshire					) 30 miles calculated in with M6 in Lancashire
	Lancashire					) (24 miles now Greater Manchester C.C.).
	W. Yorkshire	40	17.7	708.4	708.4	Using Yorkshire mean from the M1
M63	Cheshire	6	5.8	34.8	34.8	Urban Motorway. Now Greater Manchester C.C.
	(Lancashire)	(6)				Included in Lancashire total
	Total	365				
A1(M), A66(M) A194(M)	Hertfordshire	18	11.0	198.0		Using Hertfordshire mean from M1
	S. Yorkshire	16	10.9	174.4		Doncaster By-Pass
	N. Yorkshire	8	10.9	87.2		Using Doncaster By-Pass mean
	Co. Durham	34	10.9	370.6		Using Doncaster By-Pass mean
	Total	76			830.2	
	Grand Total	1102 miles			13,835.5 acs = Average 12.6 acs/mile	
		1763 km			5,603.4 ha = Average 3.2 ha/km	

Table 6.1 Analysis of highway factors contributing to Agent Authority (County Council) motorway grass management policies in 1974. DOE instructions refer to the Instructions H.11/73 issued in 1973.

		FACTORS		
COUNTY	POLICY BACKGROUND	ACCESS AND REVEALMENT	DITCHES AND DRAINS	FIRE
AVON	Would apply DOE instructions (see p.22) as previously interpreted by Gloucestershire C.C. Had some mileage of motorway in the early stage of grass sward establishment. Not concerned about development of scrub so long as it did not affect stability of the earthworks, structures, etc.	Access required to ditches and drains for their management.	Need to control long growth blocking ditches and drains.	Fire break required along fence lines to prevent (stubble) fires spreading in from adjacent land.
BEDFORDSHIRE	Policy was based on DOE instructions.	Access required behind the hard shoulder for maintenance workers on foot. Also to reveal marker posts, accident signs and other furniture.	Maintenance of drainage was an important factor.	Fires often occurred in the most inaccessible places, but fire hazard was not a reason for general grass management.
BERKSHIRE	DOE instructions were taken as a useful guide. Grass management was seen broadly in the general context of highway maintenance.			
BUCKINGHAMSHIRE	M1. DOE instructions were taken as a general background to County policy. Grassed areas seen as part of the capital investment; where the investment was not at risk there was no point in maintaining them.	To reveal boundary fence which was inspected daily from the carriageway.		At one time used to mow to reduce fire hazard, but as fires could start anywhere, the risk scarcely justified the cost. No longer an important reason for grass management.
	M40. A rural motorway. In general the aim was to do as little as possible to grassed areas.		Maintenance of French drains was one of the main reasons for grass management.	Concerned about fire risk, especiallly where it might spread in from neighbouring land.
CHESHIRE	Policy was based on DOE instructions in 1973: previously grass was maintained by a more intensive cutting programme. New sections of the M56 and M62 had been mown by the Council rather than the Contractor from an early stage after sowing.			Not much fire hazard on the motorway banks generally, but quite concerned in the Chat Moss area west of Manchester (M62).
CUMBRIA	Account was taken of the DOE instructions but modified because of cost and work involved, especially during the grass sward establishment period.	Access required to structures, manholes, marker posts, fences for inspection and repair.		Needed to cut fire breaks at tops of cutting slopes to prevent fires spreading in from adjacent land.
DERBYSHIRE	Policy was based on DOE instructions.	Access required behind the hard shoulder for pedestrians (maintenance workers, or car occupants after breakdown).		Grass was mown to reduce fire hazard; but fires still occurred in planted areas and sometimes in dried-out, cut vegetation.
CO. DURHAM	DOE instructions were used as a guide, with reservations.			Fire hazard considered an important reason for grass management.

Table 6.1 (contd.)

COUNTY	POLICY BACKGROUND	FACTORS: ACCESS AND REVEALMENT	FACTORS: DITCHES AND DRAINS	FACTORS: FIRE
GLOUCESTERSHIRE	Worked to DOE instructions.	Access required across banks and slopes. Also control growth to reveal the edge of the carriageway.	Managed grass for maintenance of drainage.	Fire not a problem on the M5 except near bridges.
HAMPSHIRE	Broadly in agreement with DOE instructions. County policy pre-dated completion of the M3 which was still in the grass sward establishment period in 1974.	To reveal marker posts.	To prevent blocking of the particular design of plastic drainage channels used in Hampshire.	Danger of fire from stubble burning on adjacent land would be a reason for grass mowing in high risk areas.
HEREFORD AND WORCESTER	DOE instructions were found useful as a guide. Basically managed grass for the stability of the banks.	Required for revealment of marker posts, count down signs and across sight lines. Also to help in the considerable problem of litter control.	Required to keep the filter drains clear.	Fire hazard was important, particularly from burning vehicles on the hard shoulder. There were real dangers of the spread of fires, and problems of extinguishing them once they had got a hold.
HERTFORDSHIRE	Policy was based on DOE instructions.	To keep vegetation clear of guard rails and to reveal marker posts.		No fires in the previous two years and fire risk was not a reason for managing grass on motorways.
KENT	County policy pre-dated DOE instructions. Main concentration of effort was immediately behind the hard shoulder.			
LANCASHIRE	County policies were the result of experience. DOE instructions encouraged denser growth of vegetation than could be dealt with by the machines in local use.	To reveal marker posts and to help in the control of litter.		Uncut grass represented a fire risk. Had also experienced fire spreading in from adjacent land.
LEICESTERSHIRE	DOE instructions were a useful guide, with the County Council working towards the recommendations. Growth of long grass slowed down work when it was to be cut, but this was not an especial problem. Would have liked more intensive management immediately behind the hard shoulder.	Help in the control of litter.		Risk of fire not a reason for grass mowing.
NORTHAMPTONSHIRE	DOE instructions gave some advice, and support, to the County's minimum management policies. Cash and labour were the limiting factors for grass management.			
NOTTINGHAMSHIRE	DOE instructions gave a useful guide, especially as to acceptable heights of vegetation.			Risk of fire not a reason for grass mowing.
SOMERSET	Bound as an Agent Authority by the instructions of the DOE. On the M5 cut all accessible areas (by machine or hand) to aid sward development. However, grass cutting was unproductive and economic considerations would govern policies after the initial grass sward establishment period (2 years) was completed.	Expected that litter control would be a factor after the establishment period.		No experience of fire in 1974.

Table 6.1 (contd.)

COUNTY	POLICY BACKGROUND	FACTORS: ACCESS AND REVEALMENT	FACTORS: DITCHES AND DRAINS	FACTORS: FIRE
STAFFORDSHIRE	Followed the DOE instructions implicitly. Worked out well if the workmen used their discretion.	Required for revealment of road edge, markers and other furniture.		Risk of fire was not a reason for grass mowing.
SURREY	County policy pre-dated DOE instructions. M3 was still in the sward establishment period. DOE policies were too costly and labour demanding.			
WARWICKSHIRE	The two highway divisions concerned adopted rather different standards.	Required for revealment of marker posts and to help in the control of litter.		Fire hazard was an important reason for mowing grass.
WILTSHIRE	Policy was based on DOE instructions. M4. Quite intensive management during the grass sward establishment period up to 1973. In 1974, changed to less intensive programmes. Object was to stabilise the top soil, otherwise to let vegetation develop naturally and scrub develop where it would. Noted that dense vegetation could help to contain a vehicle that had run off the carriageway.	Required to keep low vegetation immediately behind hard shoulder for easy access to vehicles on the hard shoulder. Required also to reveal marker posts.	Important to control growth in the narrow strip of about 18 inches between the edge of the hard shoulder and the lateral French drains.	No experience of fire. Not a reason for managing grass.
NORTH YORKSHIRE	DOE instructions were found useful.	Required access to fences and ditches. Need to cut grass for the revealment of markers.		No problem from fire. Likely that the cut grass mulch helped to reduce the risk.
SOUTH YORKSHIRE	Policies were based on previous West Riding arrangements.	Required management next to the hard shoulder for access. Also required to reveal edge of the carriageway, marker posts, count down signs and other furniture.	Control vegetation that might block drainage.	Fire hazard a risk but not sufficient to warrant special measures. There was some danger of fire spreading onto the motorway from adjacent land.
WEST YORKSHIRE	DOE instructions were taken as a general guide reinforcing County policy. Long-term objective of grass management was to prevent succession from grassland to scrub and trees.	Required management next to the hard shoulder for access to vehicles waiting there.	Prevent vegetation from obstructing ditches.	Fire hazard was a general problem, but specific fire risk areas were closely watched.
GWENT	Welsh Office instructions were used as the County policy.	Required management for general safety reasons (only two lane carriageways) and to prevent vegetation overhanging the hard shoulder.	Kept cut-off drains and ditches clear of vegetation by keeping grass short and ensuring that grass cuttings did not block the drains.	Fire risk was not a reason for grass mowing.
COUNTY COUNCILS STARTING MOTORWAY MANAGEMENT IN 1975				
GREATER MANCHESTER	Would base policies on the DOE instructions. The Motorways were being taken over as going concerns from Cheshire and Lancashire.			
OXFORDSHIRE	Not yet had a need to consider in detail.	Grass mowing would be required to help define the edge of the carriageway.		
WEST MIDLANDS	Had considered the DOE instructions and subsequently written own County Technical Instruction.			

Table 6.2 Analysis of amenity and agricultural factors contributing to Agent Authority (County Council) motorway grass management policies in 1974.

COUNTY	AMENITY	WEED CONTROL
AVON	Managed for a fairly uniform appearance. Bear in mind that plants that are attractive during their growth may look unsightly when they die off.	Farmers expected reasonable weed control to be practised on motorway areas. The Council was sensitive to agricultural pressures and to the general requirements of good husbandry.
BEDFORDSHIRE		Farmers were apparently satisfied, no complaints about weeds.
BERKSHIRE	Landscaping of the motorway (M4) was good. Management of grassed areas was carried out for amenity and to complement the landscape design.	The Weeds Act was not a consideration in grass cutting programmes, but the County would take special action where a particular weed problem arose. Dock control was practised mainly for the sake of appearance.
BUCKINGHAMSHIRE		On the M1 there were occasional complaints about weeds so that weed control was a reason for grass management. On the M40 individual weed problems were dealt with as they arose, but weed control was not a general reason for management. The Weeds Act was not a consideration in grass cutting programmes.
CHESHIRE	Pressure from conservation and amenity organisations was a factor in the change over from intensive to less intensive management in 1973 and subsequently.	Weeds were controlled prior to 1973 by relatively intensive mowing. Subsequently weeds had been controlled by spot spraying with herbicides and by mowing along the fence lines.
CUMBRIA	Managed grassed areas so that they blended intelligently into the countryside.	Control of weeds was important but not a reason for overall management.
DERBYSHIRE	Managed for general amenity. Did not like to see hayfields. Wanted green grass, not browned-off tops.	Weeds were kept under control by the mowing regime and so did not appear as an important factor.
CO. DURHAM	Had a pride in the appearance of the A1(M) and liked to keep the grass short.	There was a rather general interpretation of 'weeds' to include a wide range of species other than grasses. Concerned about these on flat areas and when they could be seen, but not on embankments.
GLOUCESTERSHIRE	Some divergence of opinion between a preference for management to country park standards (i.e. quite intensively managed grass), and management to allow a more natural development of vegetation. In the first case the development of weeds in motorway tree plantations was an amenity problem.	
HAMPSHIRE	Managed grassed areas for their overall appearance. The motorway (M3) was not to be an intrusion into the countryside.	No complaints about weeds on the motorway in 1974, mainly as a result of anticipating trouble spots. 1974 was a bad year in the County for ragwort which had to be pulled up and carted away.
HEREFORD AND WORCESTER	Very concerned about conservation of the fauna and flora and consequently did not use sprays extensively.	Control of weeds was a reason for management, especially if there were complaints from farmers. At present, weeds were controlled by hand cutting (for conservation reasons), but there was a feeling that sprays ought to be used.
HERTFORDSHIRE		No complaints about weeds on the motorways in 1974. Trouble spots were anticipated and given individual treatment.
KENT	Managed the grass to avoid a corridor effect, and tried to shape the managed areas to conform to the landscape design; otherwise, especially on banks, allowed the vegetation to develop naturally.	Liked to take a realistic approach to weeds and to apply control measures only where necessary. It was important to control docks at as early a stage as possible. Had recently had a working party with MAFF to establish the agricultural need for weed control on non-agricultural land.
LANCASHIRE	General amenity was an important reason for management, with additional emphasis on the management of banks visible from adjoining housing. There was a strong feeling of the M6 (in particular) being identified with the County, and that a high standard of management reflected the County's concern about it.	Controlled docks, thistles and coltsfoot especially. The National Farmers' Union was likely to complain if weeds were not controlled.

Table 6.2 (contd.)

COUNTY	AMENITY	WEED CONTROL
LEICESTERSHIRE	Did not like to see long grass growing on the banks.	Weed control was a reason for grass mowing. Especially concerned about ragwort and thistle.
NORTHAMPTONSHIRE	Were aware of the amenity considerations of uncut areas but lacked resources to do anything about them. Would have liked to do much more.	Had a big weed control programme in 1973, and had had no complaints about weeds *since*. *Weeds* were not a reason for general grass management but would have programmes to control them if the need arose.
NOTTINGHAMSHIRE	Appearances, and the conservation of fauna and flora, were important considerations.	Had not received any complaints about weeds. Not a reason for general grass management.
SOMERSET	Would take requirements of fauna and flora into consideration when drawing up policies of management, once the initial grass sward establishment period was over.	Had not had any complaints so far (except about weeds on unmanaged areas of the M5 Taunton By-Pass still in the Works Contractors' hands). Weed control would not be a reason for general management but would probably be dealt with by local spot spraying as necessary.
STAFFORDSHIRE	Managed vegetation for overall amenity and appearance.	Some local infestations of weeds needed to be controlled following complaints from farmers.
SURREY	The M3 was still in the two year grass sward establishment period.	
WARWICKSHIRE	M6 Midland Link. In the Rugby Division liked to keep a high standard of management (ideally not more than 6 inches of growth of grass) for amenity and tidiness. In the Coleshill Division less exacting standards were aimed for, but liked to conform so far as possible with the neighbouring authorities on either side.	Weed control was a reason for grass mowing in Warwickshire.
WILTSHIRE	Considered that natural development of vegetation was an amenity, and important for conservation of fauna and flora.	Concerned about injurious weeds scheduled in the Weeds Act and their control was a reason for management where they occurred. Some difficulty in 1974 with complaints from the NFU about thistles and docks, and from the Police over thistle-down obscuring visibility. As this occurred too late for effective spot spraying some areas had to be mown. Had noted that farmers would often tolerate weeds along fence lines that they would complain about on the motorway banks.
NORTH YORKSHIRE	Sought to respond to comments from the public.	Seldom received complaints about weeds, so that their control was not a reason for management.
SOUTH YORKSHIRE	Amenity considerations were most important around the built-up areas by the M1 in the north of the County, but these considerations were also important throughout the County.	Weeds were not a serious problem. Mostly dealt with by local use of hand spraying.
WEST YORKSHIRE	Managed some areas for amenity, but amenity not a reason for overall management.	If weeds were not controlled by management practised for other purposes, then their control would be a reason. Some problems with docks about which comments had been made by MAFF, especially on the newer areas of M62, M606 and M621.
GWENT		Occasional complaints from farmers about weeds. *Local infestations controlled by spraying.*
COUNTY COUNCILS STARTING MOTORWAY MANAGEMENT IN 1975		
GREATER MANCHESTER		
OXFORDSHIRE	Would manage for amenity depending on the situation and what was appropriate.	Anticipated pressures from farmers and from the NFU for control measures if weeds proliferated.
WEST MIDLANDS	Would manage for amenity and tidiness near built-up areas.	Control of weeds would be a reason for management. Likely to take the view that all plants other than grasses were weeds unless told otherwise.

Table 6.3 Response of Agent Authorities (County Councils) in 1974 to the idea that grassed and planted areas were, or might be, important in the conservation of wildlife, as a secondary use of the land. Together with reports on wildlife casualties on the carriageway.

AVON	The Highway Department liked the idea of the land reverting to its natural state. Quite a number of wildlife corpses were seen in the first few months after the opening of a new section of motorway, but subsequently there was a marked reduction. Neither deer nor badgers had been seen on the motorway in Avon.
BEDFORDSHIRE	About 2 foxes were killed per year and 9-10 deer, together with swans, owls and pheasants, and numbers of smaller birds, including budgerigars. Numbers also of small mammals, including rats, weasels, ferrets and stoats. Occasional escapes of farm animals onto the motorway. A wide range of animals affected but not in any great numbers. Dogs and cats were killed in built-up areas.
BERKSHIRE	Generally sympathetic to the idea of wildlife conservation on the motorway banks. Experience of one deer being killed and 2 or 3 foxes. Deer warning signs had been erected in West Berkshire. Some dogs had been killed. No badger underpasses. The build-up of the rabbit population was damaging the grass and causing erosion.
BUCKINGHAMSHIRE	M1. Sympathetic to conservation providing that there was not a financial commitment. No badger underpasses but only one or two badgers killed in the last two years, although there used to be quite a lot. Water deer sometimes killed, and foxes, cats and dogs. In general, the problems of wildlife deaths on the motorway seemed to be receding and it was observed that more animals were killed on small rural roads. M40. Liked the idea of the banks of the M40 as a place for wild animals and plants to live, but recognised that the motorway was a barrier to wildlife. No badgers killed, one deer at Stokenchurch, and foxes at Gerrards Cross. Occasional dogs and cats. More wildlife casualties on County rural roads than on the motorway.
CHESHIRE	Conservation/environmental pressures varied and played a large part in the change in management policy from intensive to less intensive mowing during 1973. Not so many wildlife deaths as there used to be; more on County rural roads than on the motorways. Rabbits were coming back and badgers increasing, also occasional foxes but no deer.
CUMBRIA	Forsaw some problems of rabbits as pests, and the County Council had joined the Rabbit Clearance Society. Mole hills were a nuisance and made mowing difficult in some areas. Some badgers had been seen, but no recent casualties. About 7 deer killed, 2 of which were caught on the wire fence. There was a deer fence and deer warning signs in the north of the County. Young crows feeding on spilled corn were killed and other casualties occurred from time to time, but in general there were more casualties on the side roads than on the motorway.
DERBYSHIRE	Noticeably fewer wildlife deaths since the early days of the motorway. There had been no reports of deer or badgers being killed in Derbyshire. Foxes, rabbits, hares, rats and other small mammals did get killed on occasions. Swans lived on nearby gravel pits and sometimes strayed onto the carriageway where they might be either killed in flight, or on the ground.
CO. DURHAM	Did not think of the motorway banks generally in terms of conservation of plants. Foxes, dogs, occasional cats and crows got killed. Used to have badgers killed but none recently. No deer. Also some incidents with farm animals and animals escaping from transporters on the motorway. Voles were a great nuisance barking the stems of planted trees.
GLOUCESTERSHIRE	Sympathetic to the conservation idea. Some dogs and badgers had been killed; no deer, nor hedgehogs (which are widely killed on County roads).
HAMPSHIRE	Very sympathetic to wildlife and grass management policies devised with conservation in mind. More domestic dogs and cats killed than wild animals. Occasionally a fox killed and about 12 roe deer per annum. No badger deaths; no badger underpasses.
HEREFORD AND WORCESTER	Very sympathetic to wildlife conservation, co-operating with conservation interests over management, and over the planting of wild species (see Chapter 4). Occasional badgers were killed, but a badgers sett on one of the motorway banks was active. No deer casualties although there were certainly deer in the surrounding country. About one fox killed per month; there appeared to be more casualties in the mating season than at other times. Quite a lot of dogs and cats were killed, but fewer hedgehogs than on County roads.
HERTFORDSHIRE	Sympathetic to the conservation idea. About 5 deer injured in the last eight years. No deer fencing and no badger underpasses - possibly no badgers (but see Clark, 1973). Some deaths of foxes, dogs and cats but no problem with rabbits or from farm stock.
KENT	Sympathetic to the conservation idea, which was comparatively new - nobody was considering it 10-15 years ago. Some trouble with rabbits (under the provisions of the Pests Act 1954), and the County might have to do some scrub clearance to give access to control them. Badgers were using some culverts instead of crossing the carriageway. Fewer deaths of badgers and of birds than in the early years after the opening of the M2.
LANCASHIRE	"Motorway the only place left in the countryside for wildlife". County Surveyor and Highway Department staff were most sympathetic to wildlife conservation. More wildlife deaths on County rural roads than on the motorways, probably because of the volume of traffic. In the early years after opening of a motorway, there were usually a certain number of casualties but these got less as time went on. Quite a number of rabbits about, but no pest problem at present. Plenty of wildlife to be seen; one badger killed recently, no deer. Not much trouble with farm stock, although cows did try to get through the fence to the lusher grass on the motorway side.

Table 6.3 (contd.)

LEICESTERSHIRE	Sympathetic to conservation and co-operated with conservation organisations (see Chapter 4). Had a fair number of wildlife deaths, especially where the motorway had cut through a wood. No badger underpasses, nor deaths of badgers, and no deer. Occasional dogs, cats, foxes, pheasants and owls killed. No problems with farm stock. Rabbits occurred but not a problem at present, although they might become one. Rats in tree plantations near to housing were a source of complaint.
NORTHAMPTONSHIRE	Not concerned about wildlife and no really wide verges on which to support wildlife. Foxes and badgers got killed, especially on the less heavily trafficked M45 rather than the M1. Also dogs and rabbits. No deer. Occasional instances of swans on the carriageway.
NOTTINGHAMSHIRE	Sympathetic to conservation and had helped local interests (see Chapter 4). Some deaths of barn owls, dogs and rather fewer cats. No recent badger kills; no badger underpasses. No rabbits. Deer fence at one point but had not seen any deer on the motorway. Generally fewer deaths on the motorway than on County rural roads.
SOMERSET	Sympathetic to the conservation idea. There were a number of deaths of wildlife (swans, crows, badgers) soon after the M5 was opened, but there had been fewer subsequently. A badger underpass was being made on one of the sections of the motorway being constructed. No deer. Fencing appeared to control stock effectively.
STAFFORDSHIRE	Not a great many wildlife deaths. No badger underpasses. No deer and no rabbits so far.
SURREY	Sympathetic to the idea of wildlife habitats on the motorway banks. Had quite a number of wildlife deaths in the early period after the motorway opened; mainly foxes, small mammals, including squirrels, dogs, badgers and deer. There was a badger underpass on the M3.
WARWICKSHIRE	In the Rugby Division some badgers and foxes had been killed, also dogs and owls. A swan was hit and the RSPCA had to be called out to deal with it. No deer. No badger underpasses. In the Coleshill Division, since completion, one deer had been killed, 3 badgers, 6 foxes, a sheep, a number of hedgehogs, an owl and 2 kestrels, together with many dogs and fewer cats. Some deer fencing had been put up, but there were no badger underpasses. Mole runs were developing in the banks.
WILTSHIRE	Very sympathetic to wildlife conservation and had co-operated in studies of regeneration of the flora following construction of the M4. Wildlife casualties were very high in the early period after completion: rabbits, badgers, crows, foxes and a lot of dogs and cats. Nevertheless it is felt now that there were more wildlife deaths on County rural roads than on the motorway. Rabbits were becoming a nuisance in some areas (mostly overspill populations from adjoining land) causing erosion and barking young trees.
NORTH YORKSHIRE	Very few wildlife casualties, probably because the immediately surrounding countryside was rather open with few areas of wildlife habitat. Dogs, foxes and rabbits were occasionally killed, but there were probably more casualties on County roads than on the motorway.
SOUTH YORKSHIRE	M1 and part M18. Very few wildlife deaths. No badgers had been killed recently and no deer at any time. A substantial part, but by no means all, of the motorways passed through built-up areas. A1(M) and part M18. Motorways were seen as being of benefit to wildlife, especially where habitats had ceased to exist in neighbouring agricultural land. The Council felt that conservation represented a sensible alternative use of the land, and at the same time helped the motorway to mature and merge with the surrounding countryside. This could usually be achieved without interfering with the aim of protecting the prime investment in the motorway itself and its associated structures. Very few wildlife casualties had occurred. Rabbits could be a nuisance and there had been some reports of rats.
WEST YORKSHIRE	Savings in money from not mowing areas in order to encourage the conservation interest had been spent on the carriageway; but when previously unmanaged areas needed to be cut, the extra work (because of the density of the vegetation) cost more. Occasional deaths of an old fox, and of some badgers. Dogs on the motorway sometimes ran themselves out, in panic, and died of heart failure. Sheep in the Pennines section of M62 had occasionally got through the fence onto the motorway. Rabbits and hares had been seen and some were killed from time to time, but numbers fluctuated.
GWENT	The M4 in Gwent had two lanes in each carriageway. It was felt that this might make it less of an obstacle to animals than a full six lane motorway and could account for the quite high numbers of wildlife casualties still occurring. These casualties might be higher than on County rural roads. About 40 foxes a year were killed; recently there had been deaths of 2 kestrels, and also a polecat. Owls were killed (thought to be attracted to the reflections from the 'cats eye' studs in the road), and rather more cats than dogs. Foxes and badgers certainly used drainage culverts under the motorway, but there were no badger underpasses as such. Rabbits were present but not in any numbers. Cattle in the summer occasionally got wild when troubled by flies and broke down wooden fences, especially where there were knots in the rails.
COUNTY COUNCILS STARTING MOTORWAY MANAGEMENT IN 1975	
OXFORDSHIRE	(M40 - not yet handed over). Interested in the conservation potential of the motorway and had co-operated with the Nature Conservancy Council over the reinstatement of the chalk cutting through the Chiltern Scarp at Aston Rowant. One deer killed early on after the motorway was opened, and a carnage of rabbits and hares. No foxes, nor badgers so far; no badger underpasses. Did not see rabbits developing into a pest problem.
GREATER MANCHESTER	Sympathetic to conservation and anxious to know what the best forms of management for wildlife would be.
WEST MIDLANDS	Would like to know what plants were of conservation value.

Table 6.4 Response of Agent Authorities (County Councils) in 1974 to (a) the possibility of increased management if there was no resource constraint, (b) the possibility of severe resource constraint leading to instructions that there was to be no management of grassed areas.

COUNTY	INCREASED MANAGEMENT	NO MANAGEMENT
AVON	Satisfied with present level of management. Did not believe in trying to achieve wholly artificial standards when the objective was to try to make the motorway as natural a feature as possible. Would like to turn some of the big banks back to sheep grazing. In addition, it would be important not to do anything by way of over-management that might lead to erosion.	Considered that it was not possible to do less than was being done in 1974.
BEDFORDSHIRE	Satisfied with 1974 arrangements.	Would be concerned about effects of long vegetation on sightlines and on visibility in general.
BERKSHIRE	Would like to improve the standard in some places, but not looking for parkland effects.	Would not like to discontinue grass cutting altogether, although it would be a question of general appearance and neatness.
BUCKINGHAMSHIRE	M1. Would like to lay all hedges, tarmac the central reserve and pipe in the ditches. Some feeling for amenity cutting, and some against.	Would accept a 'no-management' proposal if instructed not to do any cutting.
	M40. Would not like to do any more than was done in 1974. Wanted to keep the motorway looking rural.	Doing the least possible in 1974; would be concerned about effects on the French drains if they were to do any less.
CHESHIRE	Had tried to keep the motorways tidy in the past and to prevent them from looking unkempt. In general would like to see more planting of trees and of bushes. Important to make the motorway interesting and get away from drabness and monotony.	Had quite liked the 1974 standards confining management to the area immediately by the carriageway. If now told that there was to be no management would accept, although if this had been suggested two years ago (1972) would have thought then that it would be a disaster.
CUMBRIA	Would like to cut flat areas more often, and a little more often on the slopes.	Concerned about fire risk, loss of Forestry Commission plantations and French drain marker posts, also possible deterioration of structures. Needed easy access to fences for inspection and repair. Considered that if there was no management there would be additional costs in the future.
DERBYSHIRE	With an established grass sward two cuts per annum were sufficient, per the current programme, and no more was required.	Would not accept complete embargo on management. Cost of reclamation of the grassland to an acceptable standard would cost more than the savings on regular mowing.
CO. DURHAM	Would like to cut more often than in 1974.	Fire hazard would be a worry. Also obscuration of the edge of the carriageway by long vegetation.
GLOUCESTERSHIRE	Divergence of opinion between the two Highway Divisions involved. One opinion favoured more management with the aim of producing a park-like appearance. The other did not favour this, but would still have liked the motorway to be tidier with management appropriate to individual areas.	Would be disappointed if there was an instruction to discontinue management, and would wish to try to have it modified.
HAMPSHIRE	Again a divergence of opinion. One favoured cutting all accessible, unsprayed, areas twice per season. The other considered that the 1974 policy of one cut of these areas was acceptable.	Concerned about increase of fire risk, overgrowth of vegetation, difficulties of litter control, increased deposition of litter, and general bad appearance.
HEREFORD AND WORCESTER	Would like to have more management on the central reserve. Otherwise liked to try to create interest on the motorway, and encouraging the growth of wild flowers helped in this.	Would not mind doing 'no-management' from an amenity (aesthetic) point of view, but would be concerned about hazards that might arise from neglect and particularly litter problems, blocking of French drains and fire risk.
HERTFORDSHIRE	Would not like to increase the standards. Wanted the motorways to blend into their surroundings and to avoid the feeling of their being an artificial intrusion into the countryside.	Liked to maintain as far as possible for a natural appearance. There would also be a need for some management to give access for maintenance of ditches and fences; also to preserve drainage, and to keep down the hazard of fire.
KENT	Did not want to cut any more than in 1974. Money saved on grass cutting went into the maintenance of the carriageway and structures.	Did the minimum in 1974.

Table 6.4 (contd.)

COUNTY	INCREASED MANAGEMENT	NO MANAGEMENT
LANCASHIRE	Felt that the 1974 standards were about right. Where appropriate would like to do more to bring adjacent woodlands into the motorway corridor.	Had reduced the acreage of mown grass a great deal over the years. Were trying to keep the public and especially the farmers satisfied in the spirit of good neighbourliness. Thus, the M6 between Preston and Lancaster passed through grazing land and if the motorway were not managed, it would appear very bad. Also concerned specifically about fire risk, effects on drainage and possible infestation of weeds, at present kept down by mowing.
LEICESTERSHIRE	Would like to be able to go back to the old days of the cylinder gang mowers when the men were able to take a pride in their work.	Now content to do all or nothing. Concerned about weeds and about litter.
NORTHAMPTONSHIRE	Would like to do more than at present. Felt that the motorway was below standard and untidy.	Would like to be told definitely not to cut grass so that it could be forgotten. Relatively unimportant in face of too many more important commitments.
NOTTINGHAMSHIRE	There was a general feeling amongst engineers and the public for the need to 'care for' and make the motorways tidy.	Would accept less management if it were an official instruction.
SOMERSET	Not applicable at the 1974 stage of the development of the M5 in Somerset. Would like to see the motorway corridor going back to nature, and to blend in with the countryside in the same way as the railways had done.	Must mow the first 4 ft to reveal marker posts, also mow the central reserve. Need to manage for amenity and visibility at interchanges.
STAFFORDSHIRE	Satisfied with 1974 programme.	Concerned about safety at interchanges and junctions, and about the appearance of the motorway. There would be some danger that if grass were not managed, the litter problem might become worse than it already was.
SURREY	Satisfied with the 1974 arrangements. Aimed to let natural growth develop.	Would prefer to do the minimum possible, providing environmental and safety considerations were met.
WARWICKSHIRE	Rugby Division. Satisfied with the 1974 arrangements.	Would not like to do less than in 1974. Grass had to be cut sometime, otherwise there would be a build-up of litter problems and general deterioration.
	Coleshill Division. Would like to see the motorway looking natural and wild. Opposed to intensive management.	Would be glad to do no grass cutting. However, did need to control litter, prevent blocking of French drains, and control vegetation from falling over onto the carriageway.
WILTSHIRE	No increase in management needed. Keep the motorway as unobtrusive as possible.	Need to keep weeds down and make sure that Police signs were not obscured. Need to control growth on the 18 inch strip between the edge of the hard shoulder and the French drain set behind.
NORTH YORKSHIRE	Divergence of opinion between favouring a higher standard than in 1974 of management of flat areas and cuttings, against being content with the 1974 standards.	Would accept an instruction not to mow but would be disappointed; nevertheless, this would not produce any severe maintenance problems.
SOUTH YORKSHIRE	M1 and part of M18. Would like to do more in the urban areas.	Content to do little or no mowing in rural areas except for the central reserve which was the only part that it was essential to manage. Otherwise so long as the carriageway was well defined, French drains clear, and litter collection quite easy, there would be no problems.
WEST YORKSHIRE	Would like to see their own County standards achieved, and more use made of the land by agriculture or for productive tree planting.	Would not like to be given a general instruction to stop mowing. Variety of treatment was needed, both aesthetically and for wildlife habitats. On flat areas it would be necessary to consider problems of access and the increasing fire risk.
GWENT	Would like to cut all flat areas rather than strictly two swathes as in 1974, which sometimes left small, untidy, odd shaped uncut areas at the toe of cutting slopes and tops of embankments.	Could not let the grass go wild entirely, would have at least to cut one swathe at the back of the hard shoulder. The public expected a certain minimum standard of tidiness and there was also the question of the control of weeds. Once these criteria had been satisfied then there would be no objection to letting the remaining vegetation grow wild.

Table 7.1 Management of motorway grassed areas (excluding plantations) by Agent Authorities (County Councils) in 1974. x = 'times'

COUNTY	PRIORITY MANAGEMENT AREAS	OTHER AREAS AND USE OF CHEMICALS
AVON	Six feet of flat areas behind the hard shoulder, and up to six feet at the top of adjacent embankments or top of cutting slopes, were sprayed with MH/2,4-D in May and again in September (2,4-D not always included). If growth was very strong a cut was substituted in September or early the following spring in place of the September spray.	No cutting of other areas but used spot sprays of picloram/2,4-D for dock control. In newly established areas the grass was mown on banks where there was access. Fire breaks on banks were cut if necessary in hot, dry, periods.
BEDFORDSHIRE	Two swathes (approx. two metres or seven feet) behind the hard shoulder sown 4x at about monthly intervals beginning in April.	No cutting of other areas. Atrazine granules used for control of vegetation in drainage channels and around marker posts.
BERKSHIRE	Six feet immediately behind the hard shoulder cut 2x or 3x in the season.	Cutting slopes and embankments mown to control docks and thistles as necessary. Diuron/paraquat mixture used around bridge abutments and furniture for total vegetation control. No selective herbicides were used but some MH was applied for growth retardation.
BUCKINGHAMSHIRE	M1. Flat areas, tops and bottoms of all slopes (whole of more modest slopes), two swathes up steep cuttings, all cut 3x depending on growth, in the season between May and September.	Some areas on embankments and on steep cutting slopes were not mown. Total weedkillers chosen on basis of cost. No use of selective herbicides or growth retarders.
	M40. Flat areas by French drains and one swathe behind hard shoulder cut 2x, in June, and September. Also along the tops of cutting slopes where there was a fire risk.	No cutting of other areas. French drains treated with borax weedkiller in 1974.
CHESHIRE	Flat areas, two swathes (approx. two metres or seven feet) behind the hard shoulder were cut to maintain a standard of 15 cms (six inches) growth.	All remaining areas cut 1x in June/July. Reconciled to this less intensive programme and in fact did not notice very much difference in 1974 compared to previous season: quite pleased with the effect. Made a special cut along the boundary fence when appropriate and where weeds were difficult to control. Minor use of total weedkillers under crash barriers and in drainage channels. Some use of 2,4-D and asulam for specific weed problems. No routine use of maleic hydrazide.
CUMBRIA	Flat areas and two swathes up the cutting slopes mown 4x in the season.	Tops of cutting slopes mown to maintain a fire break. Small embankments and cuttings were also mown if it would look silly to leave them. Other areas left unmown. Small use of sodium chlorate/monuron/2,4-D mixture round telephones and French drains. Picloram/2,4-D mixture used for local control of docks and nettles. No wide use of selective herbicides, and no use of MH growth retarder.
DERBYSHIRE	Flat areas and slopes cut 2x in the season starting in late April/early May. Second cut when convenient.	No use of total herbicides. Very limited quantity of picloram/2,4-D or asulam used for specific weed problems, mostly for control of docks.
CO. DURHAM	Flat areas cut 3x, starting in April; or alternatively the first 8 feet behind hard shoulder was to have been sprayed with retarder or selective weedkiller in April. Cutting slopes cut 2x coinciding with the occasions of the first two cuts on the flat. The weather in 1974 was too wet for the use of sprays behind the hard shoulder to retard growth, but this had been practised in previous years and found satisfactory. Spraying saved a lot of work, although the vegetation did have to be cut later.	General plan was to cut all the remaining areas once but not at any special time. Work done on a cycle and cutting of non-priority areas depended on progress elsewhere. First cut all round by contractor, remainder by own work force. Total herbicides used under safety rails, bridge abutments and other furniture. No selective herbicides used for weed control in 1974.
GLOUCESTERSHIRE	Flat areas and some banks sprayed with MH/2,4-D in April/May and cut later in the June to August period. In one Division slopes were cut 1x, in the other Division there was no cutting of slopes in 1974. MH/2,4-D has been found to delay growth for 8-10 weeks and was valuable to ease the work load on men and machines over a busy period. Later mowing was normally needed to maintain the standard required.	Not all the remaining cutting slopes and embankments were cut in 1974. Diuron/dalapon/MCPA-sodium mixture was used under safety rails and on French drains as a total herbicide. Selective herbicides were used for dock control.

Table 7.1 (contd.)

COUNTY	PRIORITY MANAGEMENT AREAS	OTHER AREAS AND USE OF CHEMICALS
HAMPSHIRE	In 1974, the M3 was still in the grass sward establishment period. Six feet behind the hard shoulder were sprayed with MH in April, cut in June/July, and soon afterwards resprayed with MH/2,4-D. Spray application was by contract. In 1975, the plan would be to spray MH/2,4-D in April/May, MH in June and possibly a third spray later and hope not to have to cut at all. Expect to use own resources for spraying in the future. All remaining accessible priority areas were to be cut 1x in August.	Other accessible areas mostly only cut 1x. Some inaccessible chalk banks were not cut at all. Diuron/paraquat mixture was used for total weed control. Picloram/2,4-D or asulam were used for dock control.
HEREFORD AND WORCESTER	One swathe behind the hard shoulder was cut 2x at times when it needed doing. If a small bank was involved and one swathe looked silly, then the whole bank was mown.	Other areas not cut except for hand cutting of agricultural weeds. Diuron/dalapon/MCPA used for total weed control of filter drains where vegetation had to be kept down; also around marker posts and other furniture. MH/2,4-D only used on central reserves (see Chapter 9).
HERTFORDSHIRE	One swathe behind the hard shoulder was kept down to six inches by mowing or application of MH/2,4-D.	All remaining areas, flats and slopes left uncut and had been for several years. Total weedkiller granules were used effectively under crash barriers on the level but were found to be less persistent on slopes. 2,4-D selective weedkiller spot applications were made to stands of injurious weeds where necessary.
KENT	One swathe behind hard shoulder (flat or sloping) mown 3x.	Remainder of flat and unplanted areas mown 1x in September/November period. Other areas allowed to develop naturally and to scrub-up. Simazine, aminotriazole or dichlobenil granules were used for total weed control by the crash barrier, and around other structures and furniture. Very restricted use of 2,4-D for selective weed control. Dicamba less successful against docks than well timed application of asulam.
LANCASHIRE	All flat areas, cutting slopes, and embankments in built-up areas maintained to a standard of 6-8 inches usually requiring cutting 3x a season beginning in May. In 1974, because of dry weather, 2x only were necessary in many areas. Cutting programme not on a fixed cycle. Need for mowing depended on weather and growing conditions.	Embankments not cut where they could not be seen. Atrazine used for total weed control round guard rails and other furniture. No use of selective weedkillers alone except for asulam against docks. MH/2,4-D mixture had been used on sections of the M6 Lancaster By-Pass and on very steep inaccessible banks on the M63 for the previous 4 years. Satisfied with the results obtained.
LEICESTERSHIRE	No special treatment, even immediately behind the hard shoulder which received the same treatment as adjoining areas. Cutting slopes and flats were cut 2x in the season, embankments 1x.	In 1975, embankments that could not be seen from the motorway and were not likely to result in farmer complaints about weed growth, were to be left uncut. Paraquat had been used for total weed control round guard rails, marker posts, telephone boxes and other furniture for appearances; but there was no danger of vegetation causing deterioration of these structures. Picloram/2,4-D was used for dock control, and Atrazine/paraquat round the base of newly planted trees on the M6. MH/2,4-D was not used.
NORTHAMPTONSHIRE	All flat areas cut 3x regardless of location, working on into September.	15 ft up cutting slopes and 15 ft down embankments were cut using hired machines. Weeds by bridge abutments and on banks were cut every second year, usually by hand. No use of chemicals: neither men nor machines available for their application.
NOTTINGHAMSHIRE	Cut immediately behind the hard shoulder 4x or 5x. Most other areas were cut 2x.	No cutting of embankments, some of which were not cut in 1973 either. Gorse was developing in places, and other rough vegetation, but there was no particular objection to this.
SOMERSET	M5. In the grass sward establishment period. All accessible areas mown, but some quite late in the season because of delays in delivery of machinery.	A granular formulation of sodium chlorate/monuron/2,4-D had been used for total weed control round marker posts, crash barriers, other structures and furniture. It was applied in April with satisfactory results. Picloram/2,4-D was used for dock control. There was no other use of weedkillers.

Table 7.1 (contd.)

COUNTY	PRIORITY MANAGEMENT AREAS	OTHER AREAS AND USE OF CHEMICALS
STAFFORDSHIRE	The first two swathes behind the hard shoulder were kept to 6 inches by cutting 3x. Other areas cut no more than 2x. Work started in May on some cutting slopes which were in full view of the motorway and looked untidy.	Embankments were generally not cut except to control weeds, usually in the autumn. Chlorthiamid granules were used around signs and other furniture. No selective weedkiller was bought in 1974, but remains of previous year's stock of 2,4-D was used up in local spot applications to weeds. No MH was used except on the central reserves (see Chapter 9).
SURREY	In 1974 the M3 was still in the grass sward establishment period. The first two swathes behind the hard shoulder was cut 3x, starting in May and subsequently as the need arose, but there was no cutting where there was a safety barrier. Most other areas that were cut, were cut in the late summer.	The original policy was to cut all areas up to the white posts marking tree plantations, but as the banks were found to be too steep, this policy was never put into practice. Limiting factors were the nature of the ground and the non-availability of labour. Weeds were generally controlled by hand, but there was some restricted use of diuron/paraquat for total weed control.
WARWICKSHIRE	M6 Rugby Division. The first 6 feet swathe was mown before the remainder and special attention was paid to it thereafter. Nevertheless, the general aim was to keep all areas down to 6 inches by cutting 4x to 5x in the period late April to September. M6 Coleshill Division. All areas were cut 2x between May and August using two tractors in echelon on a continuous cycle through the season.	Sodium chlorate/monuron/2,4-D was used for total weed control around structures. There was no use of selective weedkillers alone, nor spraying on embankments. Handwork was employed round individually planted trees (e.g. where not in plantations). Chlorthiamid total weedkiller was used round marker posts, and dinoseb-in-oil for dock control. MH/2,4-D was used on central reserves only (see Chapter 9).
WILTSHIRE	Two swathes behind the hard shoulder were cut at about 8 week intervals (approx. 3½x) between April and September. Work was done by two machines working in echelon.	Remaining areas were not managed except for some very weedy places. A diquat/paraquat/picloram mixture was used to clear French drains of vegetation in 1973, and also gave good control in 1974. Dalapon was used in 1974 to control bullrushes (Typha spp.) in watercourses, partly as a result of Police complaints about people stopping to pick them. Picloram/2,4-D was used on docks. Otherwise there was a general restriction on the use of chemicals, and no use of MH.
NORTH YORKSHIRE	All flat areas and cutting slopes were mown 2x, trying to get to the top of the cutting slopes where possible.	Embankments were not cut. No use of chemicals on A1(M) or A66(M). Weed control was by hand cutting.
SOUTH YORKSHIRE	Western Works Unit - M1 and part M18. Level verges up to 2m wide were cut 3x between May and September; where these were more than 2m wide, any additional ground visible from built-up areas was also cut. Embankments and cuttings were mown 1x in urban areas, otherwise only on instructions. When there was to be a single cut, this would be timed for the period May/June. Eastern Works Unit - A1(M) and part M18. All level areas by carriageway were cut 3x, first in June, second in August/September and third in October. Other level areas and cuttings were mown from fence to fence at the time of the second cut of the areas by the carriageway. Flat areas inaccessible to machines were usually cut by hand. Nothing was mown below the road (e.g. not on embankments).	Total weedkillers were applied where needed; there was restricted use of selective herbicides and no use of MH. The Council would be prepared to use growth retarders if there was more certainty about their effectiveness. Chlorthiamid total weedkiller was used round structures and furniture. There was very little use of selective weedkillers, partly because of the danger of drift. MH only was used on the central reserve (see Chapter 9).
WEST YORKSHIRE	M1. Flat areas and cutting slopes were cut 3x in May, July and September. Other areas were cut 1x or not at all. Embankments facing houses would be cut. M62, M606 and M621 were still in grass sward establishment period or only just completed in 1974. On the M62 no final third cut was made of some flat areas, and other areas were not cut at all. Would be changing to an established grassland management programme in 1975 for the M62.	Paraquat was used round trees to help establishment, otherwise there was no general use of herbicides following poor results in previous years.
GWENT	Flat areas by the hard shoulder were cut in early May, sprayed with MH/2,4-D in June/July, possibly sprayed with 2,4-D later for weed control, and finally cut in the autumn. The M4 in Gwent had only 2 lane carriageway, which made all work more difficult if they were to avoid disrupting the traffic flow.	Other areas were not managed, except occasionally for weed control. Total herbicides were used for drains. Selective herbicides were applied by contractors both for weeds and brambles.

Table 7.1 (contd.)

COUNTY	PRIORITY MANAGEMENT AREAS	OTHER AREAS AND USE OF CHEMICALS
INTENTIONS OF COUNTY COUNCILS BEGINNING MOTORWAY MAINTENANCE IN 1975		
OXFORDSHIRE	It was expected to mow the first 8 ft behind the hard shoulder about 3x and the remaining areas in the autumn.	Anticipated using total and selective herbicides for specific purposes.
WEST MIDLANDS	Expected to cut all flat areas 3x: (April)/May, June/July, and August/September. Visibility splays and slopes would be cut 2x, in May and June. Other areas would be mown as necessary for amenity purposes but not otherwise, possibly involving 1x in August/September.	Persistent total herbicides would be needed for paved areas under bridges. Selective herbicides were likely to be required and would be applied either by hand-held equipment, or by boom from a vehicle. MH would not be applied simply as a retardant, but only if by mixing it with 2,4-D there were some added benefits to the effects of 2,4-D alone.

Table 8.1 Motorway ditches and drains, and their management by Agent Authorities (County Councils) in 1974.

AVON	Had a variety of open and piped ditches, and of filter drains. Filter drains gave lateral stability to the formation but their surfaces needed to be kept clear of vegetation. In the Somerset Levels there were also drains with permanent water in which floating and submerged aquatic plants developed. In cases when both silting and obstruction to flow by vegetation occurred, machines had to be used, but where vegetation only was to be cleared, herbicides might be applied. There were some problems of access for management in all areas.
BEDFORDSHIRE	Problems arose mostly from silting for which machines were used except in inaccessible places when handwork was required. Herbicides would be used for control of vegetation if the Engineers were permitted (by County policy) to do so.
BERKSHIRE	There was generally good access to ditches, and it was possible to control growth of vegetation by machines in almost all cases.
BUCKINGHAMSHIRE	M1. Had mostly open ditches of which about 25% were accessible to machines. Vegetation reduced silting by stabilising the soil. Would like to have more ditches piped. M40. Very little maintenance. Access was difficult in places but there was no real problem. Liked to let the grass grow in order to prevent erosion.
CHESHIRE	Very varied drainage depending on the part of the County. In flat areas there were more problems with silting than erosion. Preferred to have paved open ditches which were easy to clean out and only needed annual or biennial attention. There was no use of chemicals for the control of vegetation, partly as a result of objections to their use from anglers.
CUMBRIA	There were more open ditches by the M6 in the south of the County than in the north. Some had concrete lining. There were also open cut-off ditches at the tops of cutting slopes. Vegetation in open ditches was managed by hand scything, usually in the winter. Some use was also made of total weedkillers to clear vegetation from the surface of French drains.
DERBYSHIRE	Open ditches in flat gradient areas were liable to silt up (often with coal dust blown off lorries). Piped and stone-filled ditches were also liable to silting and to problems of overgrowth of vegetation. Access was very often difficult for maintenance. There was no use of herbicides.
CO. DURHAM	No open ditches; all piped or rubble-filled. Vegetation in rubble ditches helped to hold the stones together and was not a problem. There was no use of herbicides.
GLOUCESTERSHIRE	Ditches were mostly open and problems were forseen for the future. There was bad access to many of them and no room to work. Some had been treated with a diuron/dalapon/MCPA mixture which effectively controlled the vegetation, and no subsequent erosion had been observed.
HAMPSHIRE	Had quite a lot of open ditch, some of which had had to be reformed. There was reasonable access for ditching machines. The Council was considering the use of MH for control of growth in the ditches. This would have advantages over the destruction of vegetation caused by mechanical ditch clearance. Plastic section gutters laid from the hard shoulder across the banks created great difficulties, and prevented movement of machines along the banks. These gutters were liable to blockage by vegetation growing in the silt that gathered in them, and by tall vegetation flopping over into them from the outside.
HEREFORD AND WORCESTER	Open ditches were a problem. Access was generally bad and maintenance was mostly by handwork. There could be severe erosion after heavy rain, especially if the stabilising vegetation cover was not good.
HERTFORDSHIRE	Open ditches were generally too narrow and access too poor for them to be managed easily by machine. Consequently most work was by hand. The Council would consider use of herbicides if there were no objections.
KENT	Ditching was generally by hand but sometimes there was access for a mechanical shovel. Had used dichlobenil granules in the past for total weed control with success.
LANCASHIRE	Only very short lengths of open ditch on the M6 and no vegetation problems.
LEICESTERSHIRE	About 50% were open, and the remainder were piped. Would have preferred to have more piped as silting of open ditches was a problem. Clearing-out was mostly by hand, but a machine was used where possible. Open ditches were a barrier to hedge maintenance, and this was a further objection to them.
NORTHAMPTONSHIRE	There were many open ditches with inadequate falls, which led to silting. Access was difficult for maintenance. There were no vegetation problems and there was no use of herbicides.
NOTTINGHAMSHIRE	Mostly French drains, and no problems were forseen from plants or plant roots. The Council tried to trim open ditches out every two years. Handwork was required in the bottoms, but pedestrian operated machines were used for the sides where accessible. There was no use of herbicides.
SOMERSET	In the Somerset Levels the construction of the M5 had necessitated some realignment of ditches and watercourses, with quite complicated arrangements for their maintenance and that of the protecting fences. Silting might be a problem and also the development of aquatic vegetation in the non-drying watercourses. Nevertheless, the Council preferred to have open ditches and drains rather than piped, so that they could be easily inspected. Access was often poor and a lot of handwork was anticipated.

Table 8.1 (contd.)

STAFFORDSHIRE	Had both open and piped ditches; preferred open so they could see what was happening. Cleaned out ditches about every three years on average. Would sometimes use chemicals for suppression of plant growth.
SURREY	Advantages and disadvantages of piped and open ditches varied with the soil type. In the Bagshot Sands area there had been some collapse and silting of open ditches so that piped ditches would be preferable there. It was too soon in 1974 for vegetation problems to have developed by the M3.
WARWICKSHIRE	Open ditches had some silting and vegetation problems. Access varied from areas where it was reasonable for machines to be used, to others where access for handwork only was possible. The County Council was cautious of the use of herbicides bearing in mind problems of downstream users, and of erosion if the vegetation was too severely affected.
WILTSHIRE	Most ditches were open and the Council would have preferred to have them piped because of maintenance problems and difficulty of access. In clay soil areas, flash floods had caused considerable erosion of ditches. There had been some use of herbicides in areas of standing water, after consultation with the Bristol and Avon River Board. Dalapon had been used, especially for bullrushes (Typha spp.).
NORTH YORKSHIRE	Had some open ditches but would have preferred to have them piped. Nevertheless, ditches were not much of a problem on the motorway. No difficulties with vegetation affecting the French drains, but if there were, then total weedkillers would be used.
SOUTH YORKSHIRE	M1 and part M18. Ditches were mostly piped. A1(M) and part M18. Ditches were mostly open but would have preferred to have them piped. Vegetation was very little problem and management was usually by hand. Some use of total herbicides on the French drains.
WEST YORKSHIRE	Open ditches were a cheaper form of drainage, although there might be some problems with vegetation. Control of pollution of runoff water was important on the M62.
GWENT	Had both open and piped ditches. Routine maintenance of open ditches was not a problem, although brambles might be a nuisance. Would use herbicides if necessary. Quite a lot of the ditches were cut through rock, or were concrete lined, so that there was less than usual soil or vegetation.
COUNTIES STARTING MOTORWAY MAINTENANCE IN 1975	
OXFORDSHIRE	Ditches did not appear to be very accessible and suspected that there would be a lot of handwork. The Thames Conservancy was very sensitive about water pollution and it was not likely that herbicides would be used.
WEST MIDLANDS	Would consider the use of herbicides in open ditches if it was safe to do so. Otherwise management would have to be mostly by hand because of the difficulty of access to the sites.

Table 8.2 Provision of hedges and fences, with a comparison of their advantages and disadvantages as seen by Agent Authorities (County Councils) in 1974.

COUNTY	FENCES	HEDGES - and comparison with fences
AVON	Hard or softwood posts with softwood rails and some post and wire fences were provided. Post and rail fences erected on the M4 and M5 up to ten years previously were still in good condition. Fences lasted better in arable than in pasture districts where they might be damaged by stock. At some stage the fences would come to the end of their useful lives and would then have to be replaced. Had used a diuron/dalapon/MCPA mixture for vegetation control to prevent deterioration of the bottom-rail, but this had been discontinued.	There were no hedges on the motorway in Avon. Hedges would not be effective as a barrier against young stock or lambs. Considered that maintenance would be costly, and probably more expensive than a fence over a comparable life span, allowing for both combined maintenance and replacement of the fence. Accident damage more difficult to repair in a hedge than a fence.
BEDFORDSHIRE	Fences were generally in good condition, although some of the older softwood posts on the M1 were showing signs of rot and needed replacement.	Had nearly 30 miles of hedge, mostly difficult to get at. Generally trimmed and some laid but not staked, involving a lot of handwork. About to begin a 'rolling programme' of hedge laying. Problems arose over disposal of hedge trimmings which had to be removed at least 200 m from the carriageway before being burnt. Replaced sections of fence following accidents, but not of the hedge. Did not consider that there was any benefit from the existing hedges.
BERKSHIRE	Softwood post and rail fences provided, with a life expectancy of 30 years. No maintenance problems on the M4 in 1974.	Some hedges of well bushed-out hawthorn had been established along older sections of the M4 between J5-J7. 30-60 cms (12-24 inches) cut off the tops in April 1974 and they would require annual inspection and trimming in the future. The hedges were not an effective stockproof barrier at that time.
BUCKINGHAMSHIRE	M1. Softwood post and rail fences provided. Quite a mileage of fence had already had to be replaced, largely because of accident damage - averaging about 8 incidents per annum. Life expectancy of fences was not known.	There were about 42 km (26 miles) of hedge on the motorway. Tried to cut every year but some lengths were quite inaccessible. Would like to use a flail for speed of work and easy disposal of cuttings, but at present all work was done by hand. There were considerable difficulties in disposing of cuttings, but they could be burnt under very favourable conditions.
	M40. Softwood post and rail fences provided, and expected to last 30 years. Some on County roads had lasted 50 years.	No hedges.
CHESHIRE	M6 fences were up to 10 years old and likely to need major replacements in another 5-6 years. Might then change to concrete post with strained wire and droppers. Cost of repairs to fences was high, with materials becoming increasingly more expensive.	There was not a substantial mileage of hedge on Cheshire motorways. The Council would not be confident of a hedge as a stockproof boundary without a fence. Maintenance of hedges would not be too much problem. Reasonable access for machines and there were workmen who could do laying and trimming. Would hope to get permission for access from farmers. Worried about possible weed control problems associated with hedges.
CUMBRIA	There were about six different kinds of fences on the M6. Wooden post and rail ones had a life expectancy of 25 years. Some wire fences were already deteriorating quite quickly. Post and rail fences damaged in road accident were charged at £8.00 per metre to repair (this was not an average figure for routine maintenance costs).	Some hedges had been planted at interchanges but not on the motorway itself. The County Council would not be keen on the idea of hedges as a replacement for fences because of maintenance problems, and the risk that they might not be stockproof.
DERBYSHIRE	Mostly post and rail fences provided. All were inspected twice yearly and repaired as necessary. Did not anticipate any major replacements in the near future.	Two short lengths of hedge, about 2300 m (2500 yards), planted in 1967/68, alive but scarcely growing in some places, probably affected by poor soil conditions. None yet laid. Hedges would be an acceptable feature of the motorway if maintained by the neighbouring landowner. Fences were easier to repair than hedges following accident damage.
CO. DURHAM	Softwood post and rail fences provided, and in good condition. Inspected yearly. Life expectancy of 10-15 years: least on clay soils where shrinkage and swelling around the posts let in air and moisture creating favourable conditions for rotting. Would have to be replaced in due course, probably again with wood rather than wire. Difficulties experienced in keeping the tension up in high tension wire fences, which were especially awkward to repair.	Did not have any hedges and would not want them on the motorway. Partly through lack of room between the ditch and the fence, and partly on account of maintenance problems.

Table 8.2 (contd.)

COUNTY	FENCES	HEDGES - and comparison with fences
GLOUCESTERSHIRE	Hard or softwood posts and softwood rails were provided, and were expected to last 15-20 years.	No hedges, but would like them on amenity considerations if there was space for them and if they really replaced the fence as a stockproof barrier. There would not always be adequate access to them for management, and it would be preferable if someone else (e.g. neighbouring farmer or landowner) maintained them.
HAMPSHIRE	Softwood post and rail fences were provided, but suffered a certain amount of damage from stock, vandalism and vehicle accidents. Estimated a life expectancy of 10 years but hoped for longer. Might change to high tension wire and dropper when the fence came up for replacement.	No hedges on the M3. Divided opinion over the relative merits of fences versus hedges, but concerned over problems of access and maintenance of hedges. Questioned the possibility of obtaining access from the neighbours side.
HEREFORD AND WORCESTER	Post and rail fences erected on some parts of the M5 were 12 years old and still in quite good condition. Original life expectancy was 50 years. Wire fences on the M50 were 15 years old and deteriorating badly in some sections. Some problems were arising from planting of hedges too close to the fences.	The establishment of hedges was included in the early specifications for the motorways, but this was later deleted. 152 km (95 miles) of hedge on the M5 and M50 in Hereford and Worcester. They acted as safety features in cushioning accidents; they also acted as a snow barrier, and as a noise barrier. It was hoped that they would replace the fences. Laying the hedges was being considered, particularly where they were spreading sideways through the fence on one side and towards the carriage-way on the other. Problems of management arose through poor access for machine trimming, and over the disposal of cuttings and trimmings. Some farmers managed the hedges on their own side, especially in the south and west of the County. Hedges were liked in the County as part of the motorway scene. As a result, just because their management was a nuisance, it was not a good reason for rejecting them.
HERTFORDSHIRE	Fences mainly in good condition but some posts rotted below ground level. Life expectancy of about another 10 years (erected 16 years ago = 26 in all).	No hedges and would not welcome them because of shortage of labour for maintenance, and because of difficulty of access. Would quite like to see them on neighbouring farmer's land at his expense.
KENT	Generally hardwood posts and softwood rails provided. Life expectancy of about 30 years.	No hedges, and would not be keen to have them because of the problems of cutting and difficulty of access to them.
LANCASHIRE	Generally post and rail (hard or softwood posts and softwood rail) but limited length of chain link and other types mostly in built-up areas. Expect another 10-15 years from the post and rail on the M6, but that a re-fencing programme would be necessary in due course. Fences quite easy to repair after accident damage.	Amenity thorn hedges on about 24 km (15 miles) of the M6 in the Lancaster By-Pass area, planted in 1960. Often no access from the motorway, but usually possible to machine trim from the farmer's side; on occasion the farmers had done the trimming themselves. No hedges laid so far. Hedges were good for amenity and conservation but more expensive to manage than fences.
LEICESTERSHIRE	Fences of hardwood posts and softwood rails were in good condition, and should last for about 30 years in all.	Quite a mileage of hedges. Topped and sided by hand. No machine work. Trimming first started in 1973 (hedges probably planted on M1 in period 1965/1966), and continued in 1974. Working round and gapping up where necessary. Hedges were for amenity and had no real function as a boundary. Hedges were not seen as replacement for the fence, which was both easier to maintain and to repair.
NORTHAMPTONSHIRE	Fences were generally standing up well but some posts were rotten and it was estimated that 80% would need replacing after 30 years life. Rails might last longer but were more prone to damage.	96 km (60 miles) of hedges were planted at the same time (1959) as the construction of the M1. Now regarded as an absolute nuisance from a maintenance point of view. Cut and lay by contract 6 km (4 miles) per year on a 15-year cycle at cost of £6.50 per chain in 1974. Considerable problems of access, of removal of cuttings and trimmings (could not be burnt in situ), whilst contractors had difficulty in obtaining stakes and binders for laying. Hedges made access to fences more difficult and hid damage to them. Had to rely on farmers to report fence damage.

Table 8.2 (contd.)

COUNTY	FENCES	HEDGES - and comparison with fences
NOTTINGHAMSHIRE	Softwood post and rail fences in quite good condition, and estimated about another 15 years of life. Patch as necessary unless there was some dramatic deterioration. Fence only cost a few hundred pounds a year to maintain at present: repairs at about £5-£8 per metre.	No hedges. Hedges would cost more for maintenance and would be less easy to repair after accident damage.
SOMERSET	Both wire fences, and post and rail were provided. In the flat Somerset Levels the area was complicated by drainage channels, and there might be more than one fence with an intermediate watercourse. Post and rail were the easiest to mend but had a shorter life expectancy of 15 years, compared to plastic-coated wire at 40 years, but wire made a less solid barrier.	No hedges. Might be acceptable on the farmer's side of the fence but there probably would not be enough room on the motorway side. Management of hedges would be a problem.
STAFFORDSHIRE	Oak post and rail fence. Oak was traditional in Staffordshire for highway fencing, with a life expectancy of 50 years. Fences were now up to 14 years old and in good condition.	About 80 km (50 miles) of hedge planted in the early 1960s. A nuisance if not properly maintained, but they never had been cut since they were planted. Intended to start laying hedges soon; access was all right. Liked to have hedges in spite of the maintenance problems. They were generally thick and well grown, to the extent that where they were well developed there was no routine maintenance of the fence behind. Damage to hedges was made good by gapping up with fresh quicks (Hawthorn).
SURREY	A variety of post and rail, chain link and sawn wood fences in different areas. Expected to have replaced 50% of the post and rail after 30 years, and to have to have replaced a fair proportion by 20 years.	No hedges. Hedge maintenance costs would probably override any advantage that they might otherwise have over fences. In addition there would be problems of access, stopping-up gaps, ensuring that they were a stockproof boundary, and of the disposal of hedge cuttings and clippings.
WARWICKSHIRE	Softwood post and rail fences provided, with (mostly) chain link in built-up areas, by schools, etc. Life expectancy between 10 and 25 years depending upon the situation. Repairs to post and rail fences (in the Coleshill Division) at £4.00/metre and some £1200 spent following accidents, vandalism and other causes in 1974/75.	No hedges and not considered to be a practical proposition because of general maintenance problems, lack of access and likely difficulties with neighbours. Hedges might encourage snow drifting, cost more to maintain than a fence, and would make inspection and maintenance of the fence itself more difficult.
WILTSHIRE	Originally softwood posts and rails were provided, but hardwood was now being used for any posts needed for replacement after damage. No natural deterioration of the softwood posts which were expected to last 15-20 years.	Had about half a mile of hedge, growing rather poorly. Would like to have more hedges. There would be no management problems with modern machinery. There might be some access problems, but generally there would be six to seven feet between the hedge and any bank. Ditches were to be piped so that there would be no obstruction from them. Yearly cost of management of hedges would be comparable to the cost of maintenance of the fences in arable areas. In cases where there was a change from arable to pasture the onus would be on the farmer to make the boundary stockproof.
NORTH YORKSHIRE	Post and rail fences in good condition. Life expectancy of 20 years, with 12 years still to go.	1000 m of hedge on the A1(M). Main problems of hedges would be in finding access for management (although it was possible that this could be done from the farmer's side), and that fences were easier to inspect and mend.
SOUTH YORKSHIRE	M1 and part M18. Mostly post and rail fences except in built-up areas. Life expectancy of the fence depended upon the ground it was set into. With good drainage they might last 30-40 years. Half-yearly detailed inspections were made. A1(M) and part M18. Post and rail fences, with life expectancy of 20 years. Starting to get some deterioration in 1974 - often from farmers hitting them with their machinery. Fences were not always 100% stock-proof. Twice weekly quick visual inspections were made, and more detailed inspections every six months.	No hedges. They would require too much maintenance. Farmers would not like them as they would sterilise the ground and encourage weeds. They could be cut by machine, but there would not be any expert labour available for laying. 64 km (40 miles) of hedges on 42 km (26 miles) of the A1(M), with some gaps. Planted in 1961. Had always had to cut by hand as there was generally no access from the motorway side, and no space between the hedge and the fence. No management programme, but cutting was done in response to complaints. Felt that the hedges did have a safety function but on balance would have preferred not to have them or their management problems. No economic advantage to have a hedge rather than a fence.

Table 8.2 (contd.)

COUNTY	FENCES	HEDGES - and comparison with fences
WEST YORKSHIRE	Hardwood or softwood post and softwood rail fences were provided. Expected these to last another 20-30 years when they might be replaced by welded steel mesh fences on metal uprights.	About 2.4 km (1.5 miles) of amenity hedge had been planted, and would very much like to have more. Whilst it was not thought that hedges would replace fences, on the Doncaster By-Pass 36,000 hedge plants were set and these had grown to the point where they were holding the fence up. Hedges could be managed by hand, power tools on air lines or other appropriate machinery. Access was generally adequate.
GWENT	Mostly softwood posts with nailed on rail fences, but some with softwood rails morticed into hardwood posts. Life expectancy of 20-25 years.	About 1.6 km (1 mile) of hedge, recently set and not establishing very well. In general management problems overrid any other advantages from hedges.
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OXFORDSHIRE	Softwood post and rail fences with a designed life expectancy of 30 years. Seven foot high strained wire and dropper deer fence in region of the Chiltern Scarp (km 12.5-14.5) at Aston Rowant.	No hedges.
WEST MIDLANDS	Hardwood post and softwood rail fences. Hoped for further 10 and perhaps 20 years life. Wire mesh or chain link fences in urban areas.	Might have some hedges on the M5, but considered that there would be management difficulties over access to them and over the disposal of trimmings and cuttings. Most likely to be handwork, which would be very costly.

Table 8.3 Cost factors for fences and hedges

FENCES	HEDGES
A. Capital cost	
1. The cost of providing fencing on 227 km (142 miles) of the M1 and M18 motorways between Luton and the A1/M18 intersection (Doncaster By-Pass) from 1958 to 1966, adjusted to 1967 prices, was £2,400,000 at c. £10,600 per km of motorway (£17,000 per mile). This represented 2.5% of the c. £95 million cost of the final construction of the motorway (Sir Owen Williams and Partners, 1973). Taking the mileage of fencing as twice that for the motorway, excluding any extra provision at junctions, slip roads and other works, the crude cost is calculated at £5.30 per metre (£4.80 per yard).	5. Specifications for hedge planting are laid down in the Specification for Road and Bridge Works (HMSO, 1969), requiring the excavation of a trench 60 cms (2 ft) wide and 45 cms (1 ft 6 ins) deep, breaking up the bottom and back filling with topsoil. This to be followed by careful planting, cultivation and subsequent replacement of any plants that die. The spacing of plants is not stipulated. Standard practice is to have two rows 30 cms (12 ins) apart, with plants spaced at 45 cms (1 ft 6 ins) in the row. This gives c. 4400 plants to the kilometre (7040 per mile).
2. Estimates by various authorities in 1974/75 for erection of wooden post and rail fencing varied between £4.50 and £6.00 per metre, to give a working approximation of £5.25 per metre (£5,250 per km) (Appendix table 8.2).	6. Current (1975) standard costs for providing hedging along roads to the specifications have been quoted as £0.50 per yard (£503 per km, £805 per mile).
3. Costs for strained plastic-coated or galvanised wire and/or welded mesh fences (as erected on parts of the M62, M5 and M3) were estimated as 50% to 60% of the standard wooden fence.	7. For comparison, Spon's (1975, p.328) quotes £0.73 per metre (£730 per km, £1168 per mile) for preparation and planting at three plants per metre in a smaller trench, this price would refer to comparatively small contracts and may not be entirely applicable to such areas as motorways.
4. For comparison, a quotation of £7.00 per chain* was obtained in 1976 from a local agricultural contractor for the simplest type of semi-permanent cattleproof fence of wooden post and three strands of barbed wire. This is equivalent to £0.34 per metre (£340 per km, £560 per mile). *1 Chain = 22 yards.	
B. Discount period and capital interest charges	
1. The discount period for motorways is calculated over 30 years.	4. As fences.
2. Interest charges of 8% per annum are being assumed for purposes of this report.	5. As fences.
3. Taking the estimates of £5,250 per km for erection of a fence (see above), the cost plus interest over 30 years can be calculated at £12,600 per km (£20,160 per mile).	6. Taking the quoted price for highway hedge planting of £503 per km, the cost plus interest over 30 years for the initial establishment of a hedge can be calculated at £1,207 per km (£1,932 per mile).
C. Life expectancy and residual asset value	
1. Agent Authorities responsible for motorway fences generally thought that the fences would last about 30 years, but few considered that they would survive significantly longer than this without major renewals (Appendix Table 8.2). In some sections of the M1 in the Midlands, where heavy clays predominate and there is shrinkage and swelling around the posts at soil level, a proportion of the posts were showing quite severe rotting 15 years after erection.	4. A reasonably well planted and maintained hedge might survive for 1000 years (Pollard et al., 1974).
2. The life expectancy of plastic-coated metal fences was estimated at 40 years in Somerset. The survival of metal fences will be affected inter alia by the efficiency of the protective coating on the metal, and by the level of acid pollution in the atmosphere, especially in industrial areas.	5. The asset value of a hedge as a barrier, for amenity, and for wildlife increases with its age.
3. The asset value of a rotted fence is nil.	

Table 8.3 (contd.)

FENCES

D. Costs of repairs and maintenance

1. The cost of repairing accident damage to motorway fences was put at £8.0 per metre in Cumbria, and £5.0-£8.0 per metre in Nottinghamshire (Appendix Table 8.2).

2. Annual routine maintenance of motorway post and rail fences varied from £10 per mile (£6.21 per km) to £100 per mile (£62.1 per km) (Appendix Table 11.1). The cost of inspection was included in the higher figures. A working estimate of £30 per km per annum seems to be realistic.

3. With strained wire fences (in some instances tensioned up to 91 kg, 200 lb) there are particular problems of retensioning the wires, so that repairs could be quite costly. However, no figures for repairs or annual maintenance of these fences were available.

E. Stockproofing

1. Wooden post and rail fences are designed to be stockproof. Additional netting may be required for sheep and lambs but this often has to be paid for by the farmer.

HEDGES

D. Management of hedges

4. A standard rate of £0.09 per metre (£144 per mile) is quoted by the Property Services Agency of the Department of the Environment (HMSO, 1973) for brushing and trimming both sides of a mature hedge, up to two years' growth, with disposal of cuttings, and cleaning the hedge bottom. Increased by 75% (25% per annum) for inflation between 1972 and 1975 the figure becomes £0.16 per metre (£256 per mile). However, this might be decreased by avoiding the need to pick up if annual trimming of softwood growth only is practised, and weed growth is controlled (largely) by the use of herbicides in the establishment period.

5. For comparison, the Marshall Committee Report on Highway Maintenance (HMSO, 1970) quotes an SMV (Standard Minute Value) of 16.5 minutes per linear yard for management of a 2.4 metre high x 1 metre wide (8 ft x 3 ft) hedge, or approximately 12 minutes for a 1.8 m, 6 ft high hedge. Estimating £1.00 an hour for an agricultural worker, thecost per metre for a 1.8 metre high hedge becomes £0.25 (£400 per mile). Spon's (op. cit.) p.328, quotes £0.30 per metre for the first year maintenance of a newly planted hedge.

6. Over the first ten years of life of a hedge there will be costs for weeding only (i.e. little or no trimming) in the first two or three years, and reduced costs (say 50% compared to a mature hedge) for trimming over the next seven years. Similarly, after cutting and laying there will be reduced costs for trimming in the two or three years following.

7. If cutting and laying of hedges are to be undertaken, traditionally on a fourteen year cycle, additional costs will be incurred. The Property Services Agency (op. cit.) in 1973 quoted £0.28 per metre, inflated by 75% to £0.49 to give £490 per km (£784 per mile) in 1975. This compares with £6.50 per chain, £325 per km (£520 per mile) paid by one Agent Authority in 1974 (ref. 49, Appendix Table 11.1).

8. No costs have been seen for repairs to short stretches of hedge following fire or accident damage.

2. Hedges are not usually 100% stockproof, although if well grown and properly managed they should be. It would be necessary by motorways to reinforce them with post and barbed wire or sheep netting as appropriate. The cost of an agriculturally acceptable barbed wire fence is given at para. A.4 above as £340 per km (£560 per mile). For the purposes of these calculations the life expectancy is estimated as 10 years.

Table 8.3 (contd.)

FENCES			HEDGES		
F. Comparison of (a) post and rail fence alone with (b) cost of fence plus establishment and management of a hawthorn hedge over 30 years life expectancy of the fence (Effects of inflation on management costs over the period assumed to apply equally in both cases)					
Per km	£	Reference	Per km	£	Reference
a) Erection of fence and interest on capital at 8%	12,600	para B.3	b) Establishment of hedge and interest on capital at 8%	1,207	para B.6
30 years maintenance @ £30 p.a. charge to income	900	para D.2	Year 1, no maintenance	-	
			Years 2-10 @ £125	1,125	para D.5/6 £250 reduced by 50%
			11-13 @ £250	750	para D.5 (£250 based on Marshall (report SMV for 1.8m (high hedge.
			14 cut and lay	490	para D.7
			15-17 @ £125	375	para D.6
			18-27 @ £250	2,500	
			28 cut and lay	490	
			29-30 @ £125	250	
				7,187	
			Erection of post and rail fence	12,600	
			Reduced maintenance of fence	600	Reduce by 1/3 as hedge replaces the fence
	13,500			20,387	
Subtract residual asset value	nil		Subtract real but indeterminable residual asset value	?	
	13,500		Less than	20,387	

Table 8.3 (contd.)

	FENCES			HEDGES		
G.	**Comparison of cost of (a) fence alone over 60 years, including replacement after year 30, with (b) cost of fence over 30 years, establishment of hedge in year 21 to replace fence and maintenance by machine trimming of annual growth over 40 years, including erection of post and barbed wire fence after year 30 to reinforce the hedge** (Effects of inflation on management costs assumed to apply equally in both cases)					
	Per km	£	Reference	Per km	£	Reference
a)	Erection of first fence and interest on capital at 8%	12,600	para B.3	b) Erection of fence and interest on capital at 8%	12,600	
	30 years maintenance at £30 p.a.	900		Maintenance over 30 years reduced	600	Reduce by 1/3 as hedge replaces the fence
	Erection of second fence after year 30 and interest on capital at 8%	12,600	para B.3 No provision for capital inflation	Plant hedge in year 21 and interest on capital at 8% for 30 years	1,207	para B.6
	30 years maintenance at £30 p.a.	900		Year 21 - no maintenance	-	
				22-30 @ £125	1,125	para D.5/6 £250 reduced by 50%
				31-60 @ £250	7,500	para D.5
				Post and barbed wire fence @ £340 in year 30, 40 and 50	1,020	para A.4, E2
		27,000			24,052	
	Subtract residual asset value	nil		Subtract real but indeterminable residual asset value	?	
		27,000		Less than	24,052	
	Subtract total from b)	24,052				
	Saving over 60 years by planting hedges	£2,948 per km of boundary				
	Saving over 60 years c:	£10,600,000 over 1763 km (1102 miles) of motorway as existing in 1975 or about £176,000 per annum.				

Table 9.1 The management of motorway central reserves by Agent Authorities (County Councils) in 1974

COUNTY	FACTORS	MANAGEMENT
AVON	Was concerned about the definition of the outside edge of the fast lane and revealment of the crash barrier. Also about the amenity aspect of the central reserve.	Managed by spraying with MH or MH/2,4-D.
BEDFORDSHIRE	An extensive weed problem occurred in the central reserve; this had to be controlled to reveal dangerous litter there; also for the definition of the outside edge of the fast lane, and to prevent obscuration of signs in the central reserve.	In 1974, about 80% of the central reserves were sprayed with MH.
BERKSHIRE	Would have liked to see vegetation on the central reserve kept down to 15 cms (6 inches), partly for control of litter which was a serious problem. Would prefer to have paved central reserves in urban areas following the DoE technical memorandum of 1971 (H.11/71).	80 km (50 miles) of central reserves were treated in 1973 with MH/2,4-D. Not retreated in 1974 in order to see if the effect would last more than one season.
BUCKINGHAMSHIRE	M1. The central reserve had recently been reconstructed, soil removed and vegetation replaced by stone chippings. Grass there was always unmanageable.	M1. All vegetation was suppressed by the use of total weedkiller. M40. Managed in 1972, 1973 and 1974 by spraying in May with MH/2,4-D. Began to get problems with growth of vegetation and had to consider second application of spray per season. Confident that control could be achieved by the use of chemicals. No cutting because of the danger and physical difficulties (crash barrier, lighting columns, other structures and furniture).
CHESHIRE	Central reserves on the M6 were being disturbed by erection of lighting columns, crash barriers, etc. Other more recently constructed motorways were also affected. Maintenance of the vegetation was required for amenity, and to prevent deterioration of structures from damp.	Managed by cutting, but considering the use of MH.
CUMBRIA		Central reserves cut, using tractor mounted mower or 'ride-on' cutter, about 3 times a season as necessary. No chemicals used except for total weedkiller on French drains, and picloram/2,4-D for docks.
DERBYSHIRE	DoE memorandum of 1971 recommended no cutting of vegetation in the central reserve and this was the general County policy. The County would have liked to cut the central reserve for appearances and control of fire hazard, but quite glad not to have to do so because of the physical difficulties of working there.	In the autumn of 1974 the southern section of the M1 in the County was cut following disturbance to the ground caused by contractors erecting the crash barrier and lighting columns.
CO. DURHAM	The central reserves were managed to reveal the crash barrier (which could be hidden by growth), and for access to it for maintenance.	Central reserves were sprayed from 1968-1973. In 1974, a 60 cm (2 ft) strip by the crash barrier was sprayed with total weedkiller and the remainder of the area was cut 2x with a rear mounted flail. In 1975, might spray again with MH/2,4-D, but expected that they would still have to cut at some stage.
GLOUCESTERSHIRE	The vegetation was managed so as not to exceed 15 cms (6 inches) in height (to prevent it flopping onto the carriageway), and for amenity.	One highway division was able to cut the central reserve in 1974 before the crash barrier was erected, and subsequently sprayed it with MH/2,4-D. In the other division the central reserve was sprayed once but not cut. Total weedkillers were used on the French drains. In 1975, it was likely that all central reserves would be managed by spraying.
HAMPSHIRE		Sprayed with MH in April 1974, and later with MH/2,4-D. In 1975, the County Council anticipated using MH/2,4-D in April and one (or possibly two) further applications of MH during the season.
HEREFORD AND WORCESTER	The central reserves were managed for weed control and amenity.	Had 36 ha (90 acres) of central reserve, of which 25 ha (63 acres) were sprayed with MH/2,4-D by contractors, and subsequently mown. Did not like to mow which was expensive and dangerous.

Table 9.1 (contd.)

COUNTY	FACTORS	MANAGEMENT
HERTFORDSHIRE	M1. Central reserve had been mostly ripped up for the installation of lighting cables, and subsequently left in rather a mess. Would have to manage the vegetation to prevent deterioration of the lighting columns, French drains, and guard rails. Management posed great problems.	Total weedkillers were used directly under the crash barrier, and annual application of MH/2,4-D was made to the remaining areas.
KENT	Liked to have a green central reserve, managed for the highway and for amenity. The central reserve was in no way a natural area.	Central reserves were impossible to cut efficiently because of the crash barrier. In the past the central reserves had been cut and then subsequently sprayed with MH/2,4-D. In 1975, expected to spray only, but anticipated that this would be less successful than both cutting and spraying.
LANCASHIRE	Central reserves should look tidy, free from litter and weeds. The Police also wanted to have an unobstructed view over to the other carriageway.	Atrazine granules were applied under the crash barrier by hand spreader; effects expected to persist for two years. The remainder was mown 1x or 2x at the same time as other sweeping, scavenging and maintenance operations involving the coning-off of the fast lane.
LEICESTERSHIRE		Cut 2x. A co-ordinated operation early on summer Sunday mornings, involving the use of a rear mounted flail machine on the wide side (crash barrier offset from the centre), pedestrian operated machines on the narrow side, and 'Flymo' machines under the barrier itself.
NORTHAMPTONSHIRE	Original policy was to leave the central reserves unmanaged but this led to some criticism, and subsequently they were cut twice by machine with some additional hand clearance.	Before erection of the crash barrier the whole 45 km (28 miles) of the M1/M45 were managed by two men on tractors; now it took 6 men a longer period to hand mow.
NOTTINGHAMSHIRE	Mostly managed for appearance.	Cut 1x in 1974 by pedestrian operated machine for the open areas, and hand work round the posts of the crash barrier. Had considered using chemicals but did not have any immediate plans to do so.
SOMERSET	Looking for uniformity and tidiness. There was very little growth on most parts of the recently constructed central reserves.	1974 - used selective sprays of picloram/2,4-D. In 1975, expected to cut in April/May and then apply picloram/2,4-D for weed control.
STAFFORDSHIRE	The M6 had been recently disturbed by the erection of crash barriers, and had not been resown.	Managed by spraying at the end of April with MH, using a hand lance. Subsequently cut when required, and when mowing could be fitted in with some other operations on the central reserve at the same time.
SURREY	The M3 was still very new. Tall vegetation did give some protection against glare at night.	Not normally cut, and too narrow to do so in some places.
WARWICKSHIRE	M6 Rugby Division. Liked to keep the central reserves to high standards.	MH/2,4-D applied by contract in May and July at 6-8 week intervals. Might also cut if it was necessary.
	M6 Coleshill Division. Main problem was the control of litter. No problem of deterioration of structures was likely to be caused by vegetation.	No alternative to spraying with MH/2,4-D, which was carried out by contract twice, in May and again in August, together with a cut if required. Satisfied with the results but not sure that it was really any better than doing nothing at all.
WILTSHIRE	The M4 central reserve was not managed in the early years but vegetation grew so high that it obscured accident and other signs, and the Police started to complain.	Management of the central reserves were not a particular problem. Mown 1x or 2x annually, usually at night in a 'train' of other operations, cutting one swathe either side of the barrier. Not worried about the barrier itself, nor the uprights which were set in 60 cm (2 ft) square concrete surrounds and so not affected by vegetation growing beside them. No use of chemicals.
NORTH YORKSHIRE	No engineering reason for cutting the central reserve and consequently no cutting was done. Nevertheless, this looked untidy. No risk of deterioration of structures or obscuration of signs. More problems in attempting to manage them than in leaving them alone.	

Table 9.1 (contd.)

COUNTY	FACTORS	MANAGEMENT
SOUTH YORKSHIRE	Western Works Unit, M1 and part M18. Crash barrier on most lengths. No formal cutting programme, but would cut if the need arose. Eastern Works Unit, part M18 and A1(M). Kept vegetation down for structural maintenance of the crash barrier. Many weeds in the central reserve following disturbance caused during the erection of the crash barrier.	Some hand cutting of thistles and use of total weedkillers when required. In 1974, sprayed with 2,4-D in April/May; cut in June, and sprayed with MH soon after the June cut.
WEST YORKSHIRE		Generally mown as required with a rear mounted flail. Had used MH/2,4-D in the past with success and were considering doing so again.
GWENT	M4. Crash barrier throughout and lighting columns on the western section. Aimed to keep vegetation off the carriageway, and to manage for amenity. So little grass was growing that there was no risk of deterioration of structures.	Managed by mowing and by use of MH/2,4-D.
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GREATER MANCHESTER	Many of the central reserves looked dreadful. Parts of the M63 had been gravelled, and total weedkiller could be used on them. Might use MH/2,4-D on grassed areas elsewhere.	
OXFORDSHIRE	Would probably use MH/2,4-D.	
WEST MIDLANDS	Where there was grass it would need cutting to prevent it flopping onto the carriageway, but otherwise did not see any reason for keeping vegetation down on the central reserve. Thought in fact that tall growth might have a function in cutting down dazzle at night. There was no problem with French drains, nor risk of deterioration of the heavily galvanised crash barrier.	Expected to cut the full width 3x, in April/May; June/July; August/September. Not considering the use of sprays unless economics were in their favour.

Table 11.1 Costs of management of grass areas by motorways (1 mile x 8 ft ≡ 1 acre); Agent Authorities (County Councils) identified by reference numbers, not all Authorities able to supply information. 1974 costs except where indicated. SMV = Standard Minute Value

County Ref.	Total cost in 1974 (or as shown) £	Percent of general maintenance expenditure %	Cost per mile of motorway £	Cost per unit area per occasion, and other factors. Costs per mile of verges, fences, hedges are per length of the feature and not of the motorway	Age of motorway(s)
2	3,100	5	115	Side-mounted flail mower cost £3.60 per acre.	Post 1973
4	-	5	-	Flail mower cutting of flat areas excluding central reserves cost £8.0 per acre; including central reserves @ £12.0 per acre. Spraying MH/2,4-D @ £10.40 per acre.	Pre 1970
5	12,000	8	245	Flail mower cutting cost £8.0-£10.0 per acre. Spraying MH @ £15 per acre.	Pre 1970
6	2,500	3.25	156	SMV for side-mounted flail was 43.40 minutes per mile of verge, at 4' width ≡ ½ acre SMV for rear-mounted flail was 29.08 minutes per mile of verge, at 6' width ≡ ¾ acre	Pre 1970
7	10,300	8.6	147	Expected to cut costs to 5% as the sward developed.	Mostly in 1971 but some up to ten years earlier
12	12,000	13.6 (1974) 14.7 (1973)	500	Motorway might be more expensive than County roads because of the 'dead' time spent travelling to and from the work site. Application of MH/2,4-D programme in 1974 cost £15 per acre.	1971
13	11,000	12	344	Figure includes £2,000 for chemicals. In addition, fence repairs and maintenance cost about £100 per mile of fence, per annum.	Pre 1970
16	5,475 (1973)	21.9	498	On the County roads side-mounted long reach flails cost £5.04 per acre and rear mounted £2.94 per acre. Spraying @ £10.0 per acre. Motorways should be comparable.	1971/72
19	2,000	6.7	210	Side-mounted flail cut approx. ¼ ac/hr @ £2 per hour ≡ £8.0 per acre.	Pre 1970
24	5,728 (1973)	8.0	205	Approximate cost for mowing was £10.62 per acre.	1971
25	648	1.7	36	Average cost for mowing was £3.11 per mile x 4-5 ft ≡ £6.22 per acre.	1971/74
27	2,400	8.3	184	Higher costs than on County roads because of higher quality, and more highly paid, labour. In addition, approximately £33 per mile for hedge cutting and a further £38 per mile for fence maintenance.	Pre 1970
30	4,809 (1973) (excludes central reserve)	10.57	192	Flail mowers cost £6.75-£7.50 per acre, depending on amount of 'dead' time travelling. £500 spent on fence maintenance.	Pre 1970
31	4,500 (1975 estimate)	4.75	140	Cutting cost £5.0-£6.0, or spraying £10.0-£11.0 per acre. Spraying of the central reserve without the crash barrier with MH/2,4-D in 1972 cost £10.09 per acre, with the crash barrier in 1973 cost £11.04 per acre.	Pre 1970
38	-	-	-	Expected a general average of 2 to 2½ acres per working day per machine for tractor mowing (approx. ¼ acre per hour).	Pre 1970

Table 11.1 (contd.)

County Ref.	Total cost in 1974 (or as shown) £	Percent of general maintenance expenditure %	Cost per mile of motorway £	Cost per unit area per occasion, and other factors. Costs per mile of verges, fences, hedges are per length of the feature and not of the motorway	Age of motorway(s)
41	29,000	32.3	467	Estimated £47 per acre per cut.	Majority in 1970
43	-	15	-	Took about 1½ hr to cut one acre and cost about £3.75 depending on the ease of the work.	Pre 1970
45	32,200	12.3	467	Includes £1,200 on chemicals. £50 per mile spent on fence inspections and some repairs in 1974/75 over a period of 10 months.	Some very new, but more than half pre 1970
47	5,400	3	125	Includes £1,000 for chemicals.	Some in 1971, but mostly pre 1970
48	-	10	-	Cutting cost £9.0 and spraying £15 per acre.	Some very new but more than half pre 1970
49	6,414	12.5	229	Hedge laying cost £6.50 per chain ≡ £520 per mile of hedge.	Pre 1970
50	3,100	4.2	147	Mowing cost £2.10 per acre. Spraying at £19 per acre (includes £9.50 for materials).	1972
51	-	5.0	-	Cutting cost 0.15p/sq.yd. ≡ £7.26 per acre, mostly for pedestrian work. Spraying MH + 2,4-D @ 0.3p/sq.yd ≡ £14.52 per acre, mostly on central reserves.	Pre 1970
52	6,075 (1973/74)	8.2 (1974)	304	Grass mowing costs were expected to increase to 10% of maintenance budget in 1975.	Pre 1970
Total	**£158,649**			**The total cost shown here represents the amount spent on 598 miles of motorway, out of the existing 1102 miles. The cost of grass management of the total mileage in 1974 can therefore be calculated at £292,359, equivalent to £265 per mile (£165 per km).**	